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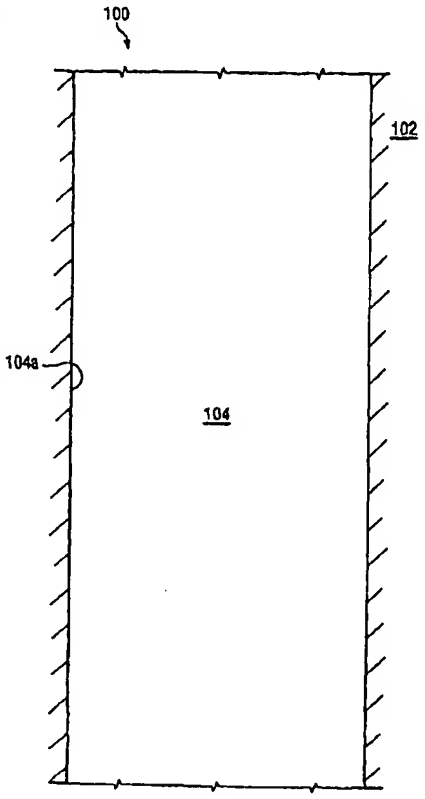
(54) Title: METHOD AND APPARATUS FOR COUPLING EXPANDABLE TUBULAR MEMBERS



(57) Abstract: An expandable tubular coupling apparatus includes a first expandable tubular member, a second expandable tubular member, and means for coupling the first expandable tubular member to the second expandable tubular member.

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METHOD AND APPARATUS FOR COUPLING EXPANDABLE TUBULAR MEMBERS

Cross Reference To Related Applications

[0001] This application claims the benefit of the filing date of US provisional patent application serial number 60/702,935, attorney docket number 25791.133, filed on July 27, 2005, the disclosure of which is incorporated herein by reference.

[0002] This application is related to the following co-pending applications: (1) U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (2) U.S. patent application serial no. 09/510,913, attorney docket no. 25791.7.02, filed on 2/23/2000, which claims priority from provisional application 60/121,702, filed on 2/25/99, (3) U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (4) U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (5) U.S. patent application serial no. 10/169,434, attorney docket no. 25791.10.04, filed on 7/1/02, which claims priority from provisional application 60/183,546, filed on 2/18/00, (6) U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (7) U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (8) U.S. patent number 6,575,240, which was filed as patent application serial no. 09/511,941, attorney docket no. 25791.16.02, filed on 2/24/2000, which claims priority from provisional application 60/121,907, filed on 2/26/99, (9) U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (10) U.S. patent application serial no. 09/981,916, attorney docket no. 25791.18, filed on 10/18/01 as a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (11) U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (12) U.S. patent application serial no. 10/030,593, attorney docket no. 25791.25.08, filed on 1/8/02, which claims priority from provisional application 60/146,203, filed on 7/29/99, (13) U.S. provisional patent application serial no. 60/143,039, attorney docket no. 25791.26, filed on 7/9/99, (14) U.S. patent application serial no. 10/111,982, attorney docket no.

25791.27.08, filed on 4/30/02, which claims priority from provisional patent application serial no. 60/162,671, attorney docket no. 25791.27, filed on 11/1/1999, (15) U.S. provisional patent application serial no. 60/154,047, attorney docket no. 25791.29, filed on 9/16/1999, (16) U.S. provisional patent application serial no. 60/438,828, attorney docket no. 25791.31, filed on 1/9/03, (17) U.S. patent number 6,564,875, which was filed as application serial no. 09/679,907, attorney docket no. 25791.34.02, on 10/5/00, which claims priority from provisional patent application serial no. 60/159,082, attorney docket no. 25791.34, filed on 10/12/1999, (18) U.S. patent application serial no. 10/089,419, filed on 3/27/02, attorney docket no. 25791.36.03, which claims priority from provisional patent application serial no. 60/159,039, attorney docket no. 25791.36, filed on 10/12/1999, (19) U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (20) U.S. patent application serial no. 10/303,992, filed on 11/22/02, attorney docket no. 25791.38.07, which claims priority from provisional patent application serial no. 60/212,359, attorney docket no. 25791.38, filed on 6/19/2000, (21) U.S. provisional patent application serial no. 60/165,228, attorney docket no. 25791.39, filed on 11/12/1999, (22) U.S. provisional patent application serial no. 60/455,051, attorney docket no. 25791.40, filed on 3/14/03, (23) PCT application US02/2477, filed on 6/26/02, attorney docket no. 25791.44.02, which claims priority from U.S. provisional patent application serial no. 60/303,711, attorney docket no. 25791.44, filed on 7/6/01, (24) U.S. patent application serial no. 10/311,412, filed on 12/12/02, attorney docket no. 25791.45.07, which claims priority from provisional patent application serial no. 60/221,443, attorney docket no. 25791.45, filed on 7/28/2000, (25) U.S. patent application serial no. 10/, filed on 12/18/02, attorney docket no. 25791.46.07, which claims priority from provisional patent application serial no. 60/221,645, attorney docket no. 25791.46, filed on 7/28/2000, (26) U.S. patent application serial no. 10/322,947, filed on 1/22/03, attorney docket no. 25791.47.03, which claims priority from provisional patent application serial no. 60/233,638, attorney docket no. 25791.47, filed on 9/18/2000, (27) U.S. patent application serial no. 10/406,648, filed on 3/31/03, attorney docket no. 25791.48.06, which claims priority from provisional patent application serial no. 60/237,334, attorney docket no. 25791.48, filed on 10/2/2000, (28) PCT application US02/04353, filed on 2/14/02, attorney docket no. 25791.50.02, which claims priority from U.S. provisional patent application serial no. 60/270,007, attorney docket no. 25791.50, filed on 2/20/2001, (29) U.S. patent application serial no. 10/465,835, filed on 6/13/03, attorney docket no. 25791.51.06, which claims priority from provisional patent application serial no. 60/262,434, attorney docket no. 25791.51, filed on 1/17/2001, (30) U.S. patent application serial no. 10/465,831, filed on 6/13/03, attorney docket no. 25791.52.06, which claims priority from U.S. provisional patent application serial no. 60/259,486, attorney

docket no. 25791.52, filed on 1/3/2001, (31) U.S. provisional patent application serial no. 60/452,303, filed on 3/5/03, attorney docket no. 25791.53, (32) U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (33) U.S. patent number 6,561,227, which was filed as patent application serial number 09/852,026 , filed on 5/9/01, attorney docket no. 25791.56, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (34) U.S. patent application serial number 09/852,027, filed on 5/9/01, attorney docket no. 25791.57, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (35) PCT Application US02/25608, attorney docket no. 25791.58.02, filed on 8/13/02, which claims priority from provisional application 60/318,021, filed on 9/7/01, attorney docket no. 25791.58, (36) PCT Application US02/24399, attorney docket no. 25791.59.02, filed on 8/1/02, which claims priority from U.S. provisional patent application serial no. 60/313,453, attorney docket no. 25791.59, filed on 8/20/2001, (37) PCT Application US02/29856, attorney docket no. 25791.60.02, filed on 9/19/02, which claims priority from U.S. provisional patent application serial no. 60/326,886, attorney docket no. 25791.60, filed on 10/3/2001, (38) PCT Application US02/20256, attorney docket no. 25791.61.02, filed on 6/26/02, which claims priority from U.S. provisional patent application serial no. 60/303,740, attorney docket no. 25791.61, filed on 7/6/2001, (39) U.S. patent application serial no. 09/962,469, filed on 9/25/01, attorney docket no. 25791.62, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (40) U.S. patent application serial no. 09/962,470, filed on 9/25/01, attorney docket no. 25791.63, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (41) U.S. patent application serial no. 09/962,471, filed on 9/25/01, attorney docket no. 25791.64, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (42) U.S. patent application serial no. 09/962,467, filed on 9/25/01, attorney docket no. 25791.65, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority

from provisional application 60/124,042, filed on 3/11/99, (43) U.S. patent application serial no. 09/962,468, filed on 9/25/01, attorney docket no. 25791.66, which is a divisional of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (44) PCT application US 02/25727, filed on 8/14/02, attorney docket no. 25791.67.03, which claims priority from U.S. provisional patent application serial no. 60/317,985, attorney docket no. 25791.67, filed on 9/6/2001, and U.S. provisional patent application serial no. 60/318,386, attorney docket no. 25791.67.02, filed on 9/10/2001, (45) PCT application US 02/39425, filed on 12/10/02, attorney docket no. 25791.68.02, which claims priority from U.S. provisional patent application serial no. 60/343,674 , attorney docket no. 25791.68, filed on 12/27/2001, (46) U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (47) U.S. utility patent application serial no. 10/516,467, attorney docket no. 25791.70, filed on 12/10/01, which is a continuation application of U.S. utility patent application serial no. 09/969,922, attorney docket no. 25791.69, filed on 10/3/2001, which is a continuation-in-part application of U.S. patent no. 6,328,113, which was filed as U.S. Patent Application serial number 09/440,338, attorney docket number 25791.9.02, filed on 11/15/99, which claims priority from provisional application 60/108,558, filed on 11/16/98, (48) PCT application US 03/00609, filed on 1/9/03, attorney docket no. 25791.71.02, which claims priority from U.S. provisional patent application serial no. 60/357,372 , attorney docket no. 25791.71, filed on 2/15/02, (49) U.S. patent application serial no. 10/074,703, attorney docket no. 25791.74, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (50) U.S. patent application serial no. 10/074,244, attorney docket no. 25791.75, filed on 2/12/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (51) U.S. patent application serial no. 10/076,660, attorney docket no. 25791.76, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (52) U.S. patent application serial no. 10/076,661, attorney docket no. 25791.77, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no.

25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (53) U.S. patent application serial no. 10/076,659, attorney docket no. 25791.78, filed on 2/15/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (54) U.S. patent application serial no. 10/078,928, attorney docket no. 25791.79, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (55) U.S. patent application serial no. 10/078,922, attorney docket no. 25791.80, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (56) U.S. patent application serial no. 10/078,921, attorney docket no. 25791.81, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (57) U.S. patent application serial no. 10/261,928, attorney docket no. 25791.82, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (58) U.S. patent application serial no. 10/079,276 , attorney docket no. 25791.83, filed on 2/20/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (59) U.S. patent application serial no. 10/262,009, attorney docket no. 25791.84, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (60) U.S. patent application serial no. 10/092,481, attorney docket no. 25791.85, filed on 3/7/02, which is a divisional of U.S. patent number 6,568,471, which was filed as patent application serial no. 09/512,895, attorney docket no. 25791.12.02, filed on 2/24/2000, which claims priority from provisional application 60/121,841, filed on 2/26/99, (61) U.S. patent application serial no. 10/261,926, attorney docket no. 25791.86, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (62) PCT application US 02/36157, filed on 11/12/02,

attorney docket no. 25791.87.02, which claims priority from U.S. provisional patent application serial no. 60/338,996, attorney docket no. 25791.87, filed on 11/12/01, (63) PCT application US 02/36267, filed on 11/12/02, attorney docket no. 25791.88.02, which claims priority from U.S. provisional patent application serial no. 60/339,013, attorney docket no. 25791.88, filed on 11/12/01, (64) PCT application US 03/11765, filed on 4/16/03, attorney docket no. 25791.89.02, which claims priority from U.S. provisional patent application serial no. 60/383,917, attorney docket no. 25791.89, filed on 5/29/02, (65) PCT application US 03/15020, filed on 5/12/03, attorney docket no. 25791.90.02, which claims priority from U.S. provisional patent application serial no. 60/391,703, attorney docket no. 25791.90, filed on 6/26/02, (66) PCT application US 02/39418, filed on 12/10/02, attorney docket no. 25791.92.02, which claims priority from U.S. provisional patent application serial no. 60/346,309, attorney docket no. 25791.92, filed on 1/7/02, (67) PCT application US 03/06544, filed on 3/4/03, attorney docket no. 25791.93.02, which claims priority from U.S. provisional patent application serial no. 60/372,048, attorney docket no. 25791.93, filed on 4/12/02, (68) U.S. patent application serial no. 10/331,718, attorney docket no. 25791.94, filed on 12/30/02, which is a divisional U.S. patent application serial no. 09/679,906, filed on 10/5/00, attorney docket no. 25791.37.02, which claims priority from provisional patent application serial no. 60/159,033, attorney docket no. 25791.37, filed on 10/12/1999, (69) PCT application US 03/04837, filed on 2/29/03, attorney docket no. 25791.95.02, which claims priority from U.S. provisional patent application serial no. 60/363,829, attorney docket no. 25791.95, filed on 3/13/02, (70) U.S. patent application serial no. 10/261,927, attorney docket no. 25791.97, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (71) U.S. patent application serial no. 10/262,008, attorney docket no. 25791.98, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (72) U.S. patent application serial no. 10/261,925, attorney docket no. 25791.99, filed on 10/1/02, which is a divisional of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (73) U.S. patent application serial no. 10/199,524, attorney docket no. 25791.100, filed on 7/19/02, which is a continuation of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (74) PCT application US 03/10144, filed on 3/28/03, attorney docket no. 25791.101.02, which claims priority from

U.S. provisional patent application serial no. 60/372,632, attorney docket no. 25791.101, filed on 4/15/02, (75) U.S. provisional patent application serial no. 60/412,542, attorney docket no. 25791.102, filed on 9/20/02, (76) PCT application US 03/14153, filed on 5/6/03, attorney docket no. 25791.104.02, which claims priority from U.S. provisional patent application serial no. 60/380,147, attorney docket no. 25791.104, filed on 5/6/02, (77) PCT application US 03/19993, filed on 6/24/03, attorney docket no. 25791.106.02, which claims priority from U.S. provisional patent application serial no. 60/397,284, attorney docket no. 25791.106, filed on 7/19/02, (78) PCT application US 03/13787, filed on 5/5/03, attorney docket no. 25791.107.02, which claims priority from U.S. provisional patent application serial no. 60/387,486 , attorney docket no. 25791.107, filed on 6/10/02, (79) PCT application US 03/18530, filed on 6/11/03, attorney docket no. 25791.108.02, which claims priority from U.S. provisional patent application serial no. 60/387,961, attorney docket no. 25791.108, filed on 6/12/02, (80) PCT application US 03/20694, filed on 7/1/03, attorney docket no. 25791.110.02, which claims priority from U.S. provisional patent application serial no. 60/398,061, attorney docket no. 25791.110, filed on 7/24/02, (81) PCT application US 03/20870, filed on 7/2/03, attorney docket no. 25791.111.02, which claims priority from U.S. provisional patent application serial no. 60/399,240, attorney docket no. 25791.111, filed on 7/29/02, (82) U.S. provisional patent application serial no. 60/412,487, attorney docket no. 25791.112, filed on 9/20/02, (83) U.S. provisional patent application serial no. 60/412,488, attorney docket no. 25791.114, filed on 9/20/02, (84) U.S. patent application serial no. 10/280,356, attorney docket no. 25791.115, filed on 10/25/02, which is a continuation of U.S. patent number 6,470,966, which was filed as patent application serial number 09/850,093, filed on 5/7/01, attorney docket no. 25791.55, as a divisional application of U.S. Patent Number 6,497,289, which was filed as U.S. Patent Application serial no. 09/454,139, attorney docket no. 25791.03.02, filed on 12/3/1999, which claims priority from provisional application 60/111,293, filed on 12/7/98, (85) U.S. provisional patent application serial no. 60/412,177, attorney docket no. 25791.117, filed on 9/20/02, (86) U.S. provisional patent application serial no. 60/412,653, attorney docket no. 25791.118, filed on 9/20/02, (87) U.S. provisional patent application serial no. 60/405,610, attorney docket no. 25791.119, filed on 8/23/02, (88) U.S. provisional patent application serial no. 60/405,394, attorney docket no. 25791.120, filed on 8/23/02, (89) U.S. provisional patent application serial no. 60/412,544, attorney docket no. 25791.121, filed on 9/20/02, (90) PCT application US 03/24779, filed on 8/8/03, attorney docket no. 25791.125.02, which claims priority from U.S. provisional patent application serial no. 60/407,442, attorney docket no. 25791.125, filed on 8/30/02, (91) U.S. provisional patent application serial no. 60/423,363, attorney docket no. 25791.126, filed on 12/10/02, (92) U.S. provisional patent application serial no. 60/412,196, attorney docket no. 25791.127, filed on 9/20/02, (93) U.S. provisional patent application serial no. 60/412,187,

attorney docket no. 25791.128, filed on 9/20/02, (94) U.S. provisional patent application serial no. 60/412,371, attorney docket no. 25791.129, filed on 9/20/02, (95) U.S. patent application serial no. 10/382,325, attorney docket no. 25791.145, filed on 3/5/03, which is a continuation of U.S. patent number 6,557,640, which was filed as patent application serial no. 09/588,946, attorney docket no. 25791.17.02, filed on 6/7/2000, which claims priority from provisional application 60/137,998, filed on 6/7/99, (96) U.S. patent application serial no. 10/624,842, attorney docket no. 25791.151, filed on 7/22/03, which is a divisional of U.S. patent application serial no. 09/502,350, attorney docket no. 25791.8.02, filed on 2/10/2000, which claims priority from provisional application 60/119,611, filed on 2/11/99, (97) U.S. provisional patent application serial no. 60/431,184, attorney docket no. 25791.157, filed on 12/5/02, (98) U.S. provisional patent application serial no. 60/448,526, attorney docket no. 25791.185, filed on 2/18/03, (99) U.S. provisional patent application serial no. 60/461,539, attorney docket no. 25791.186, filed on 4/9/03, (100) U.S. provisional patent application serial no. 60/462,750, attorney docket no. 25791.193, filed on 4/14/03, (101) U.S. provisional patent application serial no. 60/436,106, attorney docket no. 25791.200, filed on 12/23/02, (102) U.S. provisional patent application serial no. 60/442,942, attorney docket no. 25791.213, filed on 1/27/03, (103) U.S. provisional patent application serial no. 60/442,938, attorney docket no. 25791.225, filed on 1/27/03, (104) U.S. provisional patent application serial no. 60/418,687, attorney docket no. 25791.228, filed on 4/18/03, (105) U.S. provisional patent application serial no. 60/454,896, attorney docket no. 25791.236, filed on 3/14/03, (106) U.S. provisional patent application serial no. 60/450,504, attorney docket no. 25791.238, filed on 2/26/03, (107) U.S. provisional patent application serial no. 60/451,152, attorney docket no. 25791.239, filed on 3/9/03, (108) U.S. provisional patent application serial no. 60/455,124, attorney docket no. 25791.241, filed on 3/17/03, (109) U.S. provisional patent application serial no. 60/453,678, attorney docket no. 25791.253, filed on 3/11/03, (110) U.S. patent application serial no. 10/421,682, attorney docket no. 25791.256, filed on 4/23/03, which is a continuation of U.S. patent application serial no. 09/523,468, attorney docket no. 25791.11.02, filed on 3/10/2000, which claims priority from provisional application 60/124,042, filed on 3/11/99, (111) U.S. provisional patent application serial no. 60/457,965, attorney docket no. 25791.260, filed on 3/27/03, (112) U.S. provisional patent application serial no. 60/455,718, attorney docket no. 25791.262, filed on 3/18/03, (113) U.S. patent number 6,550,821, which was filed as patent application serial no. 09/811,734, filed on 3/19/01, (114) U.S. patent application serial no. 10/436,467, attorney docket no. 25791.268, filed on 5/12/03, which is a continuation of U.S. patent number 6,604,763, which was filed as application serial no. 09/559,122, attorney docket no. 25791.23.02, filed on 4/26/2000, which claims priority from provisional application 60/131,106, filed on 4/26/99, (115) U.S. provisional patent application serial no. 60/459,776,

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filed on 8/11/2005; (138) PCT patent application serial number PCT/US2005/028641, attorney docket number 25791.372, filed on 8/11/2005; (139) PCT patent application serial number PCT/US2005/028819, attorney docket number 25791.373, filed on 8/11/2005; (140) PCT patent application serial number PCT/US2005/028446, attorney docket number 25791.374, filed on 8/11/2005; (141) PCT patent application serial number PCT/US2005/028642, attorney docket number 25791.375, filed on 8/11/2005; (142) PCT patent application serial number PCT/US2005/028451, attorney docket number 25791.376, filed on 8/11/2005, and (143). PCT patent application serial number PCT/US2005/028473, attorney docket number 25791.377, filed on 8/11/2005, (144) U.S. utility patent application serial number 10/546082, attorney docket number 25791.378, filed on 8/16/2005, (145) U.S. utility patent application serial number 10/546076, attorney docket number 25791.379, filed on 8/16/2005, (146) U.S. utility patent application serial number 10/545936, attorney docket number 25791.380, filed on 8/16/2005, (147) U.S. utility patent application serial number 10/546079, attorney docket number 25791.381, filed on 8/16/2005 (148) U.S. utility patent application serial number 10/545941, attorney docket number 25791.382, filed on 8/16/2005, (149) U.S. utility patent application serial number 546078, attorney docket number 25791.383, filed on 8/16/2005, filed on 8/11/2005., (150) U.S. utility patent application serial number 10/545941, attorney docket number 25791.185.05, filed on 8/16/2005, (151) U.S. utility patent application serial number 11/249967, attorney docket number 25791.384, filed on 10/13//2005, (152) U.S. provisional patent application serial number 60/734302, attorney docket number 25791.24, filed on 11/7/2005, (153) U.S. provisional patent application serial number 60/725181, attorney docket number 25791.184, filed on 10/11/2005, (154) PCT patent application serial number PCT/US2005/023391, attorney docket number 25791.299.02 filed 6/29/2005 which claims priority from U.S. provisional patent application serial number 60/585370, attorney docket number 25791.299, filed on 7/2/2004, (155) U.S. provisional patent application serial number 60/721579, attorney docket number 25791.327, filed on 9/28/2005, (156) U.S. provisional patent application serial number 60/717391, attorney docket number 25791.214, filed on 9/15/2005, (157) U.S. provisional patent application serial number 60/702935, attorney docket number 25791.133, filed on 7/27/2005, (158) U.S. provisional patent application serial number 60/663913, attorney docket number 25791.32, filed on 3/21/2005, (159) U.S. provisional patent application serial number 60/652564, attorney docket number 25791.348, filed on 2/14/2005, (160) U.S. provisional patent application serial number 60/645840, attorney docket number 25791.324, filed on 1/21/2005, (161) PCT patent application serial number PCT/US2005/043122, attorney docket number 25791.326.02, filed on 11/29/2005 which claims priority from U.S. provisional patent application serial number 60/631703, attorney docket number 25791.326, filed on 11/30/2004, (162) U.S. provisional patent application serial number 60/752787, attorney

docket number 25791.339, filed on 12/22/2005, (163) U.S. National Stage application serial no. 10/548934, attorney docket no. 25791.253.05, filed on 9/12/2005; (164) U.S. National Stage application serial no. 10/549410, attorney docket no. 25791.262.05, filed on 9/13/2005; (165) U.S. Provisional Patent Application No. 60/717391, attorney docket no. 25791.214 filed on 9/15/2005; (166) U.S. National Stage application serial no. 10/550906, attorney docket no. 25791.260.06, filed on 9/27/2005; (167) U.S. National Stage application serial no. 10/551880, attorney docket no. 25791.270.06, filed on 9/30/2005; (168) U.S. National Stage application serial no. 10/552253, attorney docket no. 25791.273.06, filed on 10/4/2005; (169) U.S. National Stage application serial no. 10/552790, attorney docket no. 25791.272.06, filed on 10/11/2005; (170) U.S. Provisional Patent Application No. 60/725181, attorney docket no. 25791.184 filed on 10/11/2005; (171) U.S. National Stage application serial no. 10/553094, attorney docket no. 25791.193.03, filed on 10/13/2005; (172) U.S. National Stage application serial no. 10/553566, attorney docket no. 25791.277.06, filed on 10/17/05; (173) PCT Patent Application No. PCT/US2006/002449, attorney docket no. 25791.324.02 filed on 1/20/06, and (174) PCT Patent Application No. PCT/US2006/004809, attorney docket no. 25791.348.02 filed on 2/9/06; (175) U.S. Utility Patent application serial no. 11/356899, attorney docket no. 25791.386, filed on 2/17/06, (176) U.S. National Stage application serial no. 10/568200, attorney docket no. 25791.301.06, filed on 2/13/2006, (177) U.S. National Stage application serial no. 10/568719, attorney docket no. 25791.137.04, filed on 2/16/06, filed on 2/16/06, (178) U.S. National Stage application serial no. 10/569323, attorney docket no. 25791.215.06, filed on 2/17/06, (179) U.S. National State patent application serial no. 10/571041, attorney docket no. 25791.305.05, filed on 3/3/06; (180) U.S. National State patent application serial no. 10/571017, attorney docket no. 25791.306.04, filed on 3/3/06; (181) U.S. National State patent application serial no. 10/571086, attorney docket no. 25791.307.04, filed on 3/6/06; and (182) U.S. National State patent application serial no. 10/571085, attorney docket no. 25791.308.07, filed on 3/6/06, (183) U.S. utility patent application serial number 10/938788, attorney docket number 25791.330, filed on 9/10/04, (184) U.S. utility patent application serial number 10/938225, attorney docket number 25791.331, filed on 9/10/04, (185) U.S. utility patent application serial number 10/952288, attorney docket number 25791.332, filed on 9/28/04, (186) U.S. utility patent application serial number 10/952416, attorney docket number 25791.333, filed on 9/28/04, (187) U.S. utility patent application serial number 10/950749, attorney docket number 25791.334, filed on 9/27/04, (188)U.S. utility patent application serial number 10/950869, attorney docket number 25791.335, filed on 9/27/04; (189) U.S. provisional patent application serial number 60/761324, attorney docket number 25791.340, filed on 1/23/06, (190) U.S. provisional patent application serial number 60/754556, attorney docket number 25791.342, filed on 12/28/05, (191) U.S. utility patent application serial number

11/380051, attorney docket number 25791.388, filed on 4/25/06, and (192) U.S. utility patent application serial number 11/380055, attorney docket number 25791.389 the disclosures of which are incorporated herein by reference.

Background

[0003] This invention relates generally to oil and gas exploration, and in particular to the expandable tubular members used to facilitate oil and gas exploration.

[0004] Conventionally, when a wellbore is created, a number of expandable tubular members are installed in the borehole to prevent collapse of the borehole wall and to prevent undesired outflow of drilling fluid into the formation or inflow of fluid from the formation into the borehole. Typically, the expandable tubular members are coupled together and may be radially expanded and plastically deformed against the borehole wall. The coupling together of the expandable tubular members and the radially expanding and plastically deforming of the coupled together expandable tubular members can raise a number of issues relating to the seal between adjacent tubular members needed to prevent undesired outflow from or inflow to the wellbore.

[0005] The present disclosure is directed to overcoming one or more of the limitations of the existing procedures for coupling expandable tubular members together during oil and gas exploration.

Summary

[0006] According to one aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a first tubular member diameter which decreases from a first outside diameter along the length of the first tubular member to a second outside diameter adjacent a first tubular member connection end on the first tubular member, a second tubular member comprising a second tubular member diameter which decreases from a third outside diameter along the length of the second tubular member to a fourth outside diameter adjacent a second tubular member connection end on the second tubular member, whereby the second tubular member connection end is positioned adjacent the first tubular member connection end, and a connection member coupled to the second outside diameter and the fourth outside diameter, whereby the connection member comprises a connection member diameter which is not substantially greater than the first outside diameter and the third outside diameter.

[0007] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a maximum first tubular member diameter, a second tubular member comprising a maximum second tubular member diameter, whereby the second tubular member is positioned adjacent the first tubular member, and means for allowing a connection member to be coupled to the first tubular member and the second tubular without a maximum connection member diameter

being substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter.

[0008] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, and an expansion channel defined by the tubular member and located on the outer surface and adjacent the thread member.

[0009] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, and means for providing a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

[0010] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, an expansion channel defined by the first tubular member and located on the outer surface and adjacent the thread member, and a second tubular member coupled the first tubular member and engaging the thread member.

[0011] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, an expansion channel defined by the first tubular member and located on the outer surface and adjacent the thread member, a tubular connection sleeve positioned on the first tubular member, an expansion slot defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel, a second tubular member coupled the first tubular member and engaging the thread member, whereby upon radial expansion and plastic deformation of the first tubular member and the second tubular member, the first tubular member and the second tubular member can withstand a pressure of up to approximately 4000 pounds per square inch.

[0012] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member defining a flange channel on a first surface of the first tubular member, and resilient means positioned in the flange channel for forming a seal between the first tubular member and a second tubular member.

[0013] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a flange member extending from a surface on the first tubular member, the flange member comprising a resilient beam extending from a distal end of the flange member for forming a seal between

the first tubular member and a second tubular member.

[0014] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member defining a flange channel on a surface of the first tubular member, a second tubular member comprising a flange member extending from a surface on the second tubular member, the second tubular member coupled to the first tubular member with the flange member positioned in the flange channel, whereby a sealing passageway is defined between the flange member and the flange channel, and resilient means for forming a seal between the first tubular member and the second tubular member positioned in the sealing passageway.

[0015] According to another aspect of the present disclosure, a connection member for coupling expandable tubular members is provided that includes a tubular connection member comprising an inner surface and an outer surface, a primary sealing member having a substantially diamond shaped cross section and extending from a substantially central location on the inner surface, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member.

[0016] According to another aspect of the present disclosure, a connection member for coupling expandable tubular members is provided that includes a tubular connection member, and means for providing a primary and secondary metal to metal seal between the tubular connection member and an expandable tubular member.

[0017] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a first connection end, a second tubular member comprising a second connection end, and a connection member coupling together the first tubular member and the second tubular member, the connection member including a tubular connection member comprising an inner surface and an outer surface, the inner surface engaging the first tubular member and the second tubular member, a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, and positioned between the first connection end and the second connection end, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member, the secondary sealing surfaces coupled to the first connection end and the second connection end.

[0018] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a first connection end, a second tubular member comprising a second connection end, a connection member coupled

to the first connection end and the second connection end; and means for providing a primary and secondary metal to metal seal between the connection member and the first tubular member and the second tubular member.

[0019] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a maximum first tubular member diameter, providing a second tubular comprising a maximum second tubular member diameter, and coupling the first tubular member to the second tubular member with a connection member comprising a maximum connection member diameter which is not substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter.

[0020] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a thread member extending from an inner surface and defining a expansion channel on the outer surface which is located adjacent the thread member, and coupling a second tubular member to the first tubular member by engaging the thread member with a thread channel in the second tubular member.

[0021] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a flange member extending from an inner surface, providing a second tubular member defining a flange channel on an outer surface, positioning a resilient member in the flange channel, and coupling the first tubular member to the second tubular member by positioning the flange member in the flange channel and adjacent the resilient member.

[0022] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a first connection end, providing a second tubular member comprising a second connection end, positioning a connection member adjacent the first connection end and the second connection end such that a primary sealing member on the connection member is positioned between the first connection end and the second connection end, and a plurality of secondary sealing surfaces are positioned adjacent the first tubular member and the second tubular member, and coupling the first tubular member to the second tubular member using the connection member.

[0023] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member, a second tubular member coupled to the first tubular member, and means for effecting a gas and fluid tight seal between the first tubular member and the second tubular member before, during, and after radial expansion and plastic deformation of the first tubular member and the second tubular member, the means providing a seal which can withstand a pressure of up to 4000 pounds

per square inch.

[0024] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a first tubular member diameter which decreases from a first outside diameter along the length of the first tubular member to a second outside diameter adjacent a first tubular member connection end on the first tubular member, a second tubular member comprising a second tubular member diameter which decreases from first outside diameter along the length of the second tubular member to the second outside diameter adjacent a second tubular member connection end on the second tubular member, whereby the second tubular member connection end is coupled to the first tubular member connection end, and a connection member coupled to the second outside diameter, whereby the connection member comprises a connection member diameter which is less than or equal to the first outside diameter.

[0025] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a tubular member comprising an inner surface and an outer surface, a plurality of thread members extending from the inner surface, and a helical expansion channel defined by the tubular member and located on the outer surface and radially adjacent each of the plurality of thread members, whereby the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

[0026] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising an inner surface and an outer surface, a plurality of thread member extending from the inner surface, a helical expansion channel defined by the first tubular member and located on the outer surface and radially adjacent each of the plurality of thread members, a second tubular member coupled the first tubular member and engaging the plurality of thread members, whereby the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the first tubular member and the second tubular member, a tubular connection sleeve positioned on the first tubular member, and a plurality of spaced apart expansion slots defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and oriented substantially perpendicularly adjacent to and with respect to the expansion channel; whereby the plurality of expansion slots on the tubular connection sleeve provides a plurality of discrete point stress concentrations on the thread member during radial expansion and plastic deformation of the first tubular member, the second tubular member, and the connection sleeve.

[0027] According to another aspect of the present disclosure, a connection member for coupling expandable tubular members is provided that includes a tubular connection member comprising an inner surface and an outer surface, a primary sealing member having

a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, and deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member on opposite sides of the primary sealing member, and deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member.

[0028] According to another aspect of the present disclosure, an expandable tubular member is provided that includes a first tubular member comprising a first connection end, a second tubular member comprising a second connection end, and a connection member coupling together the first tubular member and the second tubular member, the connection member including a tubular connection member comprising an inner surface and an outer surface, the inner surface engaging the first tubular member and the second tubular member, a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, positioned between the first connection end and the second connection end, and deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member, the secondary sealing surfaces coupled to the first connection end and the second connection end and deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member.

[0029] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a maximum first tubular member diameter, providing a second tubular comprising a maximum second tubular member diameter, coupling the first tubular member to the second tubular member with a connection member comprising a maximum connection member diameter which is not substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter, positioning the first tubular member, the second tubular member, and the connection member in a wellbore, and radially expanding and plastically deforming the first tubular member and the second tubular member, wherein the radially expanding and plastically deforming comprises one of either radially expanding and plastically deforming a first reduced diameter section on the first tubular member to substantially the maximum first tubular member diameter and radially expanding and plastically deforming a second reduced diameter section on the second tubular member to substantially the maximum second tubular member diameter or radially

expanding and plastically deforming the first tubular member and the second tubular member into engagement with the wellbore.

[0030] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a thread member extending from an inner surface and defining a expansion channel on the outer surface which is located adjacent the thread member, coupling a connection sleeve to the outer surface of the of the first tubular member, the connection sleeve defining an expansion slot oriented axially with respect the connection sleeve and which is positioned substantially perpendicularly to the expansion channel, coupling a second tubular member to the first tubular member by engaging the thread member with a thread channel in the second tubular member, positioning the first tubular member, the second tubular member, and the connection sleeve in a wellbore, and radially expanding and plastically deforming the first tubular member, the second tubular member, and the connection sleeve, whereby the expansion slot and the expansion channel provide a stress concentration which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming and provides a metal to metal seal between the thread member and the thread channel.

[0031] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a flange member extending from an inner surface, providing a second tubular member defining a flange channel on an outer surface, positioning a resilient member in the flange channel, coupling the first tubular member to the second tubular member by positioning the flange member in the flange channel and adjacent the resilient member, positioning the first tubular member and the second tubular member in a wellbore, and radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming compresses the resilient member and provides a seal between the flange member and the flange channel; whereby the radially expanding and plastically deforming provides a metal to metal seal between the flange member and the flange channel.

[0032] According to another aspect of the present disclosure, a method for coupling expandable tubular members is provided that includes providing a first tubular member comprising a first connection end, providing a second tubular member comprising a second connection end, positioning a connection member adjacent the first connection end and the second connection end such that a primary sealing member on the connection member is positioned between the first connection end and the second connection end, and a plurality of secondary sealing surfaces are positioned adjacent the first tubular member and the second tubular member, coupling the first tubular member to the second tubular member

using the connection member, whereby the coupling includes providing a metal sealing member between the first tubular member, the second tubular member, and the secondary sealing surfaces, positioning the first tubular member, the second tubular member, and the connection member in a wellbore, and radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming provides a primary seal between the primary sealing member and the first tubular member and the second tubular member, and the radially expanding and plastically deforming provides a secondary seal between the secondary sealing surfaces and the first tubular member and the second tubular member.

Brief Description of the Drawings

[0033] Fig. 1 is a cross sectional view illustrating an exemplary embodiment of a wellbore.

[0034] Fig. 2 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member.

[0035] Fig. 3 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member used with the expandable tubular member of Fig. 2.

[0036] Fig. 4 is a cross sectional view illustrating an exemplary embodiment of a connection member used with the expandable tubular members of Fig. 2 and Fig. 3.

[0037] Fig. 5a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0038] Fig. 5b is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 2 and Fig. 3 coupled together by the connection member of Fig. 4.

[0039] Fig. 5c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 2 and Fig. 3 coupled together by the connection member of Fig. 4 and including a protective sleeve coupled to the connection member.

[0040] Fig. 5d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members and the connection member of Fig. 5b positioned in the wellbore of Fig. 1.

[0041] Fig. 5e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members and the connection member positioned in the wellbore of Fig. 5d and being radially expanded and plastically deformed.

[0042] Fig. 5f is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members and the connection member positioned in the wellbore of Fig. 5d and radially expanded and plastically deformed.

[0043] Fig. 5g is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members and the connection member positioned in the wellbore of Fig. 5f and being radially expanded and plastically deformed.

[0044] Fig. 6a is a side view illustrating an exemplary embodiment of an expandable tubular member.

[0045] Fig. 6b is a cross sectional view illustrating an exemplary embodiment of the expandable tubular member of Fig. 6a.

[0046] Fig. 7 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member used with the expandable tubular member of Fig. 6b.

[0047] Fig. 8a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0048] Fig. 8b is a side view illustrating an exemplary embodiment of the expandable tubular members of Fig. 6b and Fig. 7 coupled together.

[0049] Fig. 8c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 6b and Fig. 7 coupled together.

[0050] Fig. 8d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 8c positioned in the wellbore of Fig. 1.

[0051] Fig. 8e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members positioned in the wellbore of Fig. 8d and being radially expanded and plastically deformed.

[0052] Fig. 8f is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members positioned in the wellbore of Fig. 5d and radially expanded and plastically deformed.

[0053] Fig. 8g is a schematic view illustrating an exemplary embodiment of the stress concentrations on the expandable tubular members of Fig. 8e.

[0054] Fig. 9a is a side view illustrating an exemplary embodiment of a connection sleeve.

[0055] Fig. 9b is a cross sectional view illustrating an exemplary embodiment of the connection sleeve of Fig. 9a.

[0056] Fig. 10a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0057] Fig. 10b is a side view illustrating an exemplary embodiment of the expandable tubular members of Fig. 6a and Fig. 7 coupled together and with the connection sleeve of Fig. 9a coupled to the expandable tubular member of Fig. 6a.

[0058] Fig. 10c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 6b and Fig. 7 coupled together and with the connection sleeve of Fig. 9a coupled to the expandable tubular member of Fig. 6b.

[0059] Fig. 10d is a side view illustrating an exemplary embodiment of the expandable tubular members and the connection sleeve of Fig. 10c positioned in the wellbore of Fig. 1.

[0060] Fig. 10e is a fragmentary cross sectional view illustrating an exemplary embodiment of the expandable tubular members and the connection sleeve positioned in the wellbore of

Fig. 10d and being radially expanded and plastically deformed.

[0061] Fig. 10f is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members and the connection sleeve positioned in the wellbore of Fig. 10d and radially expanded and plastically deformed.

[0062] Fig. 10g is a schematic view illustrating an exemplary embodiment of the stress concentrations on the expandable tubular members of Fig. 10e.

[0063] Fig. 10h is a graph of the results of an experimental embodiment of the method illustrated in Figs. 10a, 10b, 10c, 10d, 10e and 10f.

[0064] Fig. 11 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member.

[0065] Fig. 12 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member used with the expandable tubular member of Fig. 11.

[0066] Fig. 13a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0067] Fig. 13b is a side cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 11 and Fig. 12 coupled together with a resilient member positioned between them.

[0068] Fig. 13c is a top cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 11 and Fig. 12 coupled together with a resilient member positioned between them.

[0069] Fig. 13d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 13b positioned in the wellbore of Fig. 1 and being radially expanded and plastically deformed.

[0070] Fig. 13e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 13c positioned in the wellbore of Fig. 1 and radially expanded and plastically deformed.

[0071] Fig. 14a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0072] Fig. 14b is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 11 and Fig. 12 coupled together with a resilient member positioned between them.

[0073] Fig. 14c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 11 and Fig. 12 coupled together with a resilient member positioned between them.

[0074] Fig. 14d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 14b positioned in the wellbore of Fig. 1 and being radially expanded and plastically deformed.

[0075] Fig. 14e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 14c positioned in the wellbore of Fig. 1 and radially expanded and plastically deformed.

[0076] Fig. 15a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0077] Fig. 15b is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 11 and Fig. 12 coupled together with a resilient member positioned between them.

[0078] Fig. 15c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 11 and Fig. 12 coupled together with a resilient member positioned between them.

[0079] Fig. 15d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 15b positioned in the wellbore of Fig. 1 and being radially expanded and plastically deformed.

[0080] Fig. 15e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 15c positioned in the wellbore of Fig. 1 and radially expanded and plastically deformed.

[0081] Fig. 16 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member.

[0082] Fig. 17a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0083] Fig. 17b is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 12 and Fig. 16 coupled together.

[0084] Fig. 17c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 12 and Fig. 16 coupled together.

[0085] Fig. 17d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 17b positioned in the wellbore of Fig. 1 and being radially expanded and plastically deformed.

[0086] Fig. 17e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 17c positioned in the wellbore of Fig. 1 and radially expanded and plastically deformed.

[0087] Fig. 18 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member.

[0088] Fig. 19 is a cross sectional view illustrating an exemplary embodiment of an expandable tubular member used with the expandable tubular member of Fig. 18.

[0089] Fig. 20 is a cross sectional view illustrating an exemplary embodiment of a connection member used with the expandable tubular members of Fig. 18 and Fig. 19.

[0090] Fig. 21a is a flow chart illustrating an exemplary embodiment of a method for coupling expandable tubular members.

[0091] Fig. 21b is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 18 and Fig. 19 coupled together with the connection member of Fig. 20.

[0092] Fig. 21c is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 18 and Fig. 19 coupled together with the connection member of Fig. 20.

[0093] Fig. 21d is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 21b positioned in the wellbore of Fig. 1 and being radially expanded and plastically deformed.

[0094] Fig. 21e is a cross sectional view illustrating an exemplary embodiment of the expandable tubular members of Fig. 21c positioned in the wellbore of Fig. 1 and radially expanded and plastically deformed.

Detailed Description of the Illustrative Embodiments

[0095] Referring now to Fig. 1, a wellbore 100 is illustrated. Wellbore 100 includes a volume of earth 102 which defines a passageway 104 extending through the earth 102. The passageway 104 includes passageway surface 104a which defines an outer edge of the passageway 104. In an exemplary embodiment, the wellbore 100 is formed using conventional drilling methods known in the art. In an exemplary embodiment, the wellbore 100 may be a cased hole.

[0096] Referring now to Fig. 2, an expandable tubular member 200 is illustrated. The expandable tubular member 200 includes a base 202 having an outer surface 202a, an inner surface 202b located opposite the outer surface 202a, and defining a passageway 202c extending along the length of the base 202. Expandable tubular member 200 includes a connection end 204 located on a distal end of the base 202. Expandable tubular member 200 has an outside diameter which decreases from a maximum outside diameter 206 along a length of the base 202 to an outside diameter 208 located adjacent the connection end 204. In an embodiment, the expandable tubular member 200 decreases in diameter over a length 210 of the base 202. In an exemplary embodiment, the expandable tubular member 200 is fabricated from a metal material.

[0097] Referring now to Fig. 3, an expandable tubular member 300 is illustrated. The expandable tubular member 300 includes a base 302 having an outer surface 302a, an inner surface 302b located opposite the outer surface 302a, and defining a passageway 302c extending along the length of the base 302. Expandable tubular member 300 includes a connection end 304 located on a distal end of the base 302. Expandable tubular member 300 has an outside diameter which decreases from a maximum outside diameter 306 along

a length of the base 302 to an outside diameter 308 located adjacent the connection end 304. In an embodiment, the expandable tubular member 300 decreases in diameter over a length 310 of the base 302. In an exemplary embodiment, the expandable tubular member 300 is fabricated from a metal material.

[0098] Referring now to Fig. 4, a connection member 400 is illustrated. Connection member 400 includes a tubular base 402 having an outer surface 402a and an inner surface 402b located opposite the outer surface 402a. A pair of opposing distal ends 404a and 404b are included on opposite sides of the tubular base 402. A passageway 406 is defined by the tubular base 402 and located along the length of the tubular base 402 between distal ends 404a and 404b. The tubular base 402 has a connection member diameter 408 along the length of the tubular base 402. In an exemplary embodiment, the connection member 400 may be a variety of conventional connection members known in the art for coupling expandable tubular members. In an exemplary embodiment, the connection member 400 is fabricated from a metal material.

[0099] Referring now to Figs. 2, 3, 4, 5a, 5b, and 5c, a method 500 for coupling expandable tubular members is illustrated. The method 500 begins at step 502 where the expandable tubular member 200 and the expandable tubular member 300 are provided. The expandable tubular member 200 is positioned adjacent the expandable tubular member 300 such that the connection end 204 on expandable tubular member 200 is adjacent the connection end 304 on expandable tubular member 300.

[0100] The method 500 then proceeds to step 504 where the expandable tubular members 200 and 300 are coupled together with the connection member 400. The connection member 400 is engaged with the expandable tubular member 200 such that the inner surface 402b of the connection member 400 engages the outer surface 202a of the expandable tubular member 200 adjacent the connection end 204. The connection member 400 is then engaged with the expandable tubular member 300 such that the inner surface 402b of the connection member 400 engages the outer surface 302a of the expandable tubular member 300 adjacent the connection end 304. With the connection member 400 engaging the expandable tubular members 200 and 300, the connection ends 204 and 304 or expandable tubular members 200 and 300, respectively, are positioned in the passageway 406 on connection member 400 and engage each other, as illustrated in Fig. 5b. In an exemplary embodiment, the expandable tubular members 200 and 300 are coupled together by the engagement of the connection ends 204 and 304, respectively, such as, for example, using a convention threaded connection, and/or the engagement of the connection member 400 with the expandable tubular members 200 and 300 using convention methods known in the art. In an exemplary embodiment, the engagement of the expandable tubular members 200 and 300 and the connection member 400 provides a gas

and liquid tight seal between the expandable tubular members 200 and 300 and the connection member 400. In an exemplary embodiment, the engagement of the expandable tubular members 200 and 300 and the connection member 400 provides a metal to metal seal between the expandable tubular members 200 and 300 and the connection member 400.

[0101] With the connection member 400 engaging the expandable tubular members 200 and 300, an expandable tubular member 502a is provided in which the connection member diameter 408 is not substantially greater than the maximum outside diameter 206 on the expandable tubular member 200 or the maximum outside diameter 306 on the expandable tubular member 300. Thus, an expandable tubular member 502a is provided which has a maximum diameter that is the maximum diameter of the expandable tubular members 200 or 300 which are coupled together to form the expandable tubular member 502a, rather than the diameter of the connection member 400 which couples together the expandable tubular members 200 and 300. In an exemplary embodiment, an outer protective sleeve 502b may be coupled to the outer surface 402a of the connection member 400 and an inner protective sleeve 502c may be coupled to the inner surfaces 202b and 302b of the expandable tubular members 200 and 300, respectively, adjacent the connection ends 204 and 304, respectively, as illustrated in Fig. 5c.

[0102] Referring now to Figs. 1, 5a, 5b, and 5d, the method 500 proceeds to step 506 where the expandable tubular members 200 and 300 are positioned in the wellbore 100. The expandable tubular member 502a is positioned in the passageway 104 on wellbore 100, as illustrated in Fig. 5d. The passageway 104 may be dimensioned such that there is only a small amount of space between the passageway surface 104a and the outer surfaces 202a, 302a, and 402a of the expandable tubular member 200, the expandable tubular member 300, and the connection member 400, respectively. However, relatively large diameter expandable tubular members 200 and 300 may be used with the wellbore 100 because the coupling of the expandable tubular members 200 and 300 with the connection member 400 does not increase the outside diameter of the expandable tubular member 502a. This allows larger diameter expandable tubular members 200 and 300 to be coupled together and used in the wellbore 100 than is possible using conventional coupling methods.

[0103] Referring now to Figs. 1, 5a, 5b, 5e, 5f, and 5g, the method proceeds to step 508 where the expandable tubular members 200 and 300 are radially expanded and plastically deformed. An expansion device 508a which is coupled to a drill string 508b is provided which has larger outside diameter than the inside diameters of the portions of the expandable tubular members 200 and 300 with outside diameters 208 and 308, respectively. The expansion device 508a is positioned in the expandable tubular member 502b and moved in a direction A, as illustrated in Fig. 5e. Movement of the expansion device 508a in

direction A expands the length 310 of the expandable tubular member 300 and the portion of the expandable tubular member 300 with outside diameter 308 to a inside diameter equal to the outside diameter of the expansion device 508a.

[0104] Continued movement of the expansion device 508a in direction A expands the length 210 of the expandable tubular member 200 and the portion of the expandable tubular member 200 with outside diameter 208 to a inside diameter equal to the outside diameter of the expansion device 508a, as illustrated in Fig. 5f. In an exemplary embodiment, the expansion device 508a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art.

[0105] Thus, the expandable tubular member 502a may be positioned in a wellbore 100 with tight clearance between the expandable tubular member 502a and the passageway surface 104a and then radially expanded and plastically deformed to a monodiameter tubular member. In an exemplary embodiment, an expansion device 508c which is coupled to a drill string 50db is provided which has larger outside diameter than the inside diameters of the portions of the expandable tubular members 200 and 300 with maximum outside diameters 206 and 306, respectively. The expansion device 508c is then moved in a direction B, radially expanding and plastically deforming the expandable tubular member 502a into engagement with the passageway surface 104a of wellbore 100, as illustrated in Fig. 5g. In an exemplary embodiment, the expansion device 508c may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Thus, the expandable tubular member 502a may be positioned in a wellbore 100 with tight clearance between the expandable tubular member 502a and the passageway surface 104a and then radially expanded and plastically deformed into engagement with the passageway surface 104a of the wellbore 104.

[0106] Referring now to Figs. 6a and 6b, an expandable tubular member 600 is illustrated. The expandable tubular member 600 includes a tubular base 602 having an outer surface 602a, and inner surface 602b located opposite the outer surface 602a, a distal end 602c, and defining a passageway 602d extending along its length of the tubular base 602 to the distal end 602c. A plurality of thread members, which may be conventional thread members known in the art, such as, for example, thread member 604, extend from the inner surface 602b of the tubular base 602 into the passageway 602d and are located circumferentially about the inner surface 602b. A stress concentrator is provided on the expandable tubular member 600 and may include a plurality of expansion channels such as, for example, expansion channel 606, which are defined by the tubular base 602 and located helically about the outer surface 602a and adjacent the plurality of thread members such as, for

example, the thread member 604. In an embodiment, the expandable tubular member 600 is fabricated from a metal material.

[0107] Referring now to Fig. 7, an expandable tubular member 700 is illustrated. Expandable tubular member 700 includes a tubular base 702 having an outer surface 702a, an inner surface 702b located opposite the outer surface 702a, a distal end 702c, and defining a passageway 702d which extends from the distal end 702c and along the length of the tubular base 702. A plurality of thread channels, which may be conventional thread channels known in the art, such as, for example, the thread channel 704, are defined by the tubular base 702 and located circumferentially about the outer surface 702a. In an embodiment, the expandable tubular member 700 is fabricated from a metal material.

[0108] Referring now to Figs. 6a, 6b, 7, 8a, 8b, and 8c, a method 800 for coupling expandable tubular members is illustrated. The method 800 begins at step 802 where the expandable tubular members 600 and 700, illustrated in Figs. 6a, 6b, and 7, are provided. The method 800 then proceeds to step 804 where the expandable tubular members 600 and 700 are coupled together. The expandable tubular member 600 is positioned adjacent the expandable tubular member 700 such that the distal end 602c on expandable tubular member 600 is adjacent the distal end 702c on expandable tubular member 700. The distal end 702c on expandable tubular member 700 is then positioned in the passageway 602d on expandable tubular member 600 such that the plurality of thread members such as, for example, the thread member 604, engage the plurality of thread channels such as, for example, the thread channel 704, as illustrated in Fig. 8c, providing an expandable tubular member 804a.

[0109] Referring now to Figs. 1, 8a, and 8d, the method 800 then proceeds to step 806 where the expandable tubular members 600 and 700 are positioned in the wellbore 100. The expandable tubular member 804a is positioned in the passageway 104 of wellbore 100 such that the outer surfaces 602a and 702a of the expandable tubular members 600 and 700, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 8d.

[0110] Referring now to Figs. 8a, 8b, 8e, 8f, and 8g, the method 800 proceeds to step 808 where the expandable tubular members 600 and 700 are radially expanded and plastically deformed. An expansion device 808a which is coupled to a drill string 808b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 600 and 700. The expansion device 808a is positioned in the expandable tubular member 804a and moved in a direction C, as illustrated in Fig. 8e. Movement of the expansion device 808a in direction C expands the expandable tubular members 600 and 700 such that the outer surfaces 602a and 702a, respectively, engage the passageway surface 104a of the wellbore 100. In an exemplary embodiment, the expansion device 808a

may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Furthermore, the expansion of the expandable tubular member 804a between the distal ends 602c and 702c on expandable tubular members 600 and 700, respectively, results in the deformation of the plurality of thread members in the plurality of thread channels.

[0111] With the provision of the stress concentrator, shown as the plurality of expansion channels in this embodiment, the deformation of the plurality of thread members in the plurality of thread channels is increased relative to the deformation of a thread member in a thread channel without the stress concentrator. For example, during deformation, the expansion channel 606 allows increased deformation of the thread member 604 in the thread channel 704 by increasing the stress experienced by the thread member 604 during radial expansion and plastic deformation of the expandable tubular members 600 and 700 and increasing the deformation of the thread member 604, as illustrated in Fig. 8f, which provides a gas and liquid tight seal between the expandable tubular members 600 and 700. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 600 and 700 is a metal to metal seal.

[0112] Thus, a method and apparatus are provided which provide stress concentrations on the expandable tubular members 600 and 700 in order increase the deformation of thread members in thread channels such as, for example, the thread member 604 in the thread channel 704, to provide a seal between the thread member 604 and the thread channel 704 after the expansion of coupled together expandable tubular members 600 and 700. In an exemplary embodiment, the stress concentrator provided on the expandable tubular member 804a is a circumferential and helical stress concentration 810, as illustrated in Fig. 8g. In an exemplary embodiment, the stress concentrator may provide a variety of stress concentrations with different geometries such as, for example, point to point stress concentrations, discrete stress concentrations, and/or continuous stress concentrations.

[0113] Referring now to Figs. 9a and 9b, a connection sleeve 900 is illustrated. The connection sleeve 900 includes a tubular base 902 having an outer surface 902a, an inner surface 902b located opposite the outer surface 902a, a distal end 902c, and a passageway 902d which extends from the distal end 902c and along the length of the tubular base 902. A stress concentrator is provided on the connection sleeve 900 and may include a plurality of expansion slots 904 defined by the tubular base 902, extending from the outer surface 902a to the inner surface 902b, and located in a substantially axially orientation with respect to the tubular base 902 and spaced apart circumferentially about the tubular base 902. In an exemplary embodiment, the connection sleeve 900 is fabricated from a metal material.

[0114] Referring now to Figs. 6a, 6b, 7, 9a, 9b, 10a, and 10b, a method 1000 for coupling expandable tubular members is illustrated. The method 1000 begins at step 1002 where the

expandable tubular members 600 and 700 and the connection sleeve, illustrated in Figs. 6a, 6b, 7, 9a and 9b, are provided.

[0115] The method 1000 then proceeds to step 1004 where the expandable tubular members 600 and 700 are coupled together. The distal end 602c of expandable tubular member 600 is positioned in the passageway 902d on the connection sleeve 900 such that the inner surface 902b of the connection sleeve 900 engages the outer surface 602a of the expandable tubular member 600. With the connection sleeve 900 coupled to the expandable tubular member 600, the expansion slots 904 on connection sleeve 900 are oriented substantially perpendicularly to the plurality of expansion channels such as, for example, expansion channel 606 on expandable tubular member 600. Coupling the connection sleeve 900 to the expandable tubular member 600 provides a plurality of discrete point stress concentrators located at the intersection of the expansion slots 904 and the expansion channels.

[0116] The expandable tubular member 600 and connection sleeve 900 are then positioned adjacent the expandable tubular member 700 such that the distal ends 602c and 902c on the expandable tubular member 600 and connection sleeve 900, respectively, are adjacent the distal end 702c on expandable tubular member 700. The distal end 702c on expandable tubular member 700 is then positioned in the passageway 602d on expandable tubular member 600 such that the plurality of thread members such as, for example, the thread member 604, engage the plurality of thread channels such as, for example, the thread channel 704, and are positioned adjacent the expansion slot 904, as illustrated in Fig. 10c, providing an expandable tubular member 1004a.

[0117] Referring now to Figs. 1, 10a, and 10d, the method 1000 then proceeds to step 1006 where the expandable tubular members 600 and 700 and the connection sleeve 900 are positioned in the wellbore 100. The expandable tubular member 1004a is positioned in the passageway 104 of wellbore 100 such that the outer surface 902a of the connection sleeve 900 and the outer surfaces 602a and 702a of the expandable tubular members 700, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 10d.

[0118] Referring now to Figs. 10a, 10b, 10e, 10f, and 10g, the method 1000 proceeds to step 1008 where the expandable tubular members 600 and 700 and the connection sleeve 900 are radially expanded and plastically deformed. An expansion device 1008a which is coupled to a drill string 1008b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 600 and 700. The expansion device 1008a is positioned in the expandable tubular member 1004a and moved in a direction D, as illustrated in Fig. 10e. Movement of the expansion device 1008a in direction D expands the expandable tubular members 600 and 700 and the connection sleeve 900 such that the

outer surfaces 602a, 702a, and 902a, respectively, engage the passageway surface 104a of the wellbore 100. In an exemplary embodiment, the expansion device 808a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Furthermore, the expansion of the expandable tubular member 1004a between the distal ends 902c and 702c on the connection sleeve 900 and the expandable tubular member 700, respectively, results in the deformation of the plurality of thread members in the plurality of thread channels.

[0119] With the provision of the discrete point stress concentrators, shown as the intersection of the expansion slots 904 and the expansion channels, the deformation of the plurality of thread members in the plurality of thread channels is increased relative to the deformation of a thread member in a thread channel without the discrete point stress concentrators. For example, during deformation, the expansion channel 606 and the expansion slot 904 allow increased deformation of the thread member 604 in the thread channel 704 by increasing the stress experienced by the thread member 604 during radial expansion and plastic deformation of the expandable tubular members 600 and 700 and increasing the deformation of the thread member 604, as illustrated in Fig. 10f, which provides a gas and liquid tight seal between the expandable tubular members 600 and 700. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 600 and 700 is a metal to metal seal.

[0120] Thus, a method and apparatus are provided which provide stress concentrations on the expandable tubular member 1004a in order increase the deformation of thread members in thread channels such as, for example, the thread member 604 in the thread channel 704, to provide a seal between the thread member 604 and the thread channel 704 after the expansion of coupled together expandable tubular members 600 and 700. In an exemplary embodiment, the stress concentrator may provide stress concentrations on the expandable tubular member 1004a in discrete point stress concentrations 1010, illustrated in Fig. 10g. In an exemplary embodiment, the stress concentrator may provide stress concentrations on the expandable tubular member 1004a in variety of different manners on the expandable tubular members such as circumferential stress concentrations, point to point stress concentrations, discrete stress concentrations, and/or continuous stress concentrations. In an exemplary embodiment, the connection sleeve 900 increases the compression limits of the connection between the expandable tubular members 600 and 700 between thread member 604 and the thread channel 704.

[0121] Referring now to Fig. 10h, in an experimental embodiment EXP_1, an expandable tubular member substantially similar to the expandable tubular member 1004a, described above with reference to Figs. 10b, 10c, 10d, 10e, 10f and 10g, was provided and radially expanded and plastically deformed in substantially the same manner as described above.

The ends of the expandable tubular members 600 and 700 were capped, and the pressure in the passageways 602a and 702a of expandable tubular members 600 and 700, respectively, was increased to test the gas and liquid tight seal between the thread member 604 and the thread channel 704 on the expandable tubular members 600 and 700, respectively. The pressure was first increased to a pressure EXP_{1A}, which was approximately 2000 psig, and the pressure held constant for a time period. The pressure was then increased to a pressure EXP_{1B}, which was approximately 3000 psig, and the pressure held constant for a time period. This was an unexpected result, as seal failure was expected for this combination of expandable tubular members 600 and 700 including the connection sleeve 900 at 3000 psig. The pressure was then increased to a pressure EXP_{1C}, which was approximately 4000 psig, above which the seal failed. Thus, a method and apparatus have been provided which provides a seal between coupled and radially expanded and plastically deformed expandable tubular members 600 and 700 and connection sleeve 900 that can withstand increased pressure without failing relative to conventional coupling methods.

[0122] Referring now to Fig. 11, an expandable tubular member 1100 is illustrated. The expandable tubular member 1100 includes a tubular base 1102 having an outer surface 1102a, and inner surface 1102b located opposite the outer surface 1102a, a distal end 1102c, and defining a passageway 1102d extending along its length of the tubular base 1102 to the distal end 1102c. A plurality of flange members 1104 extend from the inner surface 1102b of the tubular base 1102 and into the passageway 1102d. In an exemplary embodiment, the expandable tubular member 1100 is fabricated from metal material.

[0123] Referring now to Fig. 12, an expandable tubular member 1200 is illustrated. The expandable tubular member 1200 includes a tubular base 1202 having an outer surface 1202a, and inner surface 1202b located opposite the outer surface 1202a, a distal end 1202c, and defining a passageway 1202d extending along its length of the tubular base 1202 to the distal end 1202c. A plurality of flange channels 1204 are defined by the tubular base 1202 and located on the outer surface 1202a of the tubular base 1202. In an exemplary embodiment, the expandable tubular member 1200 is fabricated from metal material.

[0124] Referring now to Figs. 11, 12, 13a, 13b, and 13c, a method 1300 for coupling expandable tubular members is illustrated. The method 1300 begins at step 1302 where the expandable tubular members 1100 and 1200, illustrated in Figs. 11 and 12, are provided. The method 1300 then proceeds to step 1304 where the expandable tubular members 1100 and 1200 are coupled together. A wave spring resilient member 1304a is positioned in the flange channels 1204 and about the circumference of the expandable tubular member 1200. In an exemplary embodiment, the wave spring resilient member 1304a is fabricated from a

metal material.

[0125] The expandable tubular member 1100 is then coupled to the expandable tubular member 1200 by positioning the flange members 1104 in the flange channels 1204. In an exemplary embodiment, the flange members 1104 are positioned in the flange channels 1204 by heating the expandable tubular member 1100, causing the expandable tubular member 1100 to expand, which increases the diameter of the passageway 1102d and allows the distal end of expandable tubular member 1200 to be positioned in the passageway 1102d of the expandable tubular member 1100. In an exemplary embodiment, the flange members 1104 are positioned in the flange channels 1204 by forcing the distal end of expandable tubular member 1200 into the passageway 1102d of the expandable tubular member 1100, causing the expandable tubular member 1100 to elastically deform to allow the distal end of expandable tubular member 1200 to be positioned in the passageway 1102d of the expandable tubular member 1100. In an exemplary embodiment, the flange members 1104 are conventional thread members known in the art and the flange channels 1204 are conventional thread channels known in the art, and the flange members 1104 are positioned in the flange channels 1204 by threading the thread members into the thread channels. In an exemplary embodiment, the flange members 1104 may be positioned in the flange channels 1204 using a variety of other conventional methods known in the art.

[0126] With the expandable tubular member 1200 coupled to the expandable tubular member 1100, a sealing channel is defined between the flange member 1104 and the flange channel 1204 and the wave spring resilient member 1304a is positioned in the sealing channel, as illustrated in Fig. 13b and 13c. With the expandable tubular member 1100 coupled to the expandable tubular member 1200, an expandable tubular member 1304b is provided.

[0127] Referring now to Figs. 1, 13a, 13d, and 13e, the method 1300 then proceeds to step 1306 where the expandable tubular members 1100 and 1200 are positioned in the wellbore 100. The expandable tubular member 1304b is positioned in the passageway 104 of wellbore 100 such that outer surfaces 1102a and 1202a of the expandable tubular members 1100 and 1200, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 13d.

[0128] The method 1300 proceeds to step 1308 where the expandable tubular members 1100 and 1200 are radially expanded and plastically deformed. An expansion device 1308a which is coupled to a drill string 1308b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 1100 and 1200. The expansion device 1308a is positioned in the expandable tubular member 1304b and moved in a direction E, as illustrated in Fig. 13d. Movement of the expansion device 1308a in direction E expands the expandable tubular members 1100 and 1200 such that the outer surfaces

1102a and 1202a, respectively, engage the passageway surface 104a of the wellbore 100. In an exemplary embodiment, the expansion device 1308a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Furthermore, the expansion of the expandable tubular member 1304b adjacent the flange member 1104 and the flange channel 1204 results in the deformation of the wave spring resilient member 1304a. Deformation of the wave spring resilient member 1304a provides a gas and liquid tight seal between the expandable tubular members 1100 and 1200. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 1100 and 1200 is a metal to metal seal. Thus, a method and apparatus are provided which provide a gas and liquid tight seal between two expandable tubular members 1100 and 1200 which are coupled together and radially expanded and plastically deformed.

[0129] Referring now to Figs. 11, 12, 14a, 14b, and 14c, a method 1400 for coupling expandable tubular members is illustrated. The method 1400 begins at step 1402 where the expandable tubular members 1100 and 1200, illustrated in Figs. 11 and 12, are provided. The method 1400 then proceeds to step 1404 where the expandable tubular members 1100 and 1200 are coupled together. A wave spring resilient member 1404a is positioned in the flange channels 1204 and about the circumference of the expandable tubular member 1200. In an exemplary embodiment, the wave spring resilient member 1404a is fabricated from a metal material.

[0130] The expandable tubular member 1100 is then coupled to the expandable tubular member 1200 by positioning the flange members 1204 in the flange channels 1204. In an exemplary embodiment, the flange members 1104 are positioned in the flange channels 1204 by heating the expandable tubular member 1100, causing the expandable tubular member 1100 to expand, which increases the diameter of the passageway 1202d and allows the distal end of expandable tubular member 1200 to be positioned in the passageway 1202d of the expandable tubular member 1100. In an exemplary embodiment, the flange members 1104 are positioned in the flange channels 1204 by forcing the distal end of expandable tubular member 1200 into the passageway 1202d of the expandable tubular member 1100, causing the expandable tubular member 1100 to elastically deform to allow the distal end of expandable tubular member 1200 to be positioned in the passageway 1202d of the expandable tubular member 1100. In an exemplary embodiment, the flange members 1104 are conventional thread members known in the art and the flange channels 1204 are conventional thread channels known in the art, and the flange members 1104 are positioned in the flange channels 1204 by threading the thread members into the thread channels. In an exemplary embodiment, the flange members 1104 may be positioned in the flange channels 1204 using a variety of other conventional methods known in the art.

[0131] With the expandable tubular member 1200 coupled to the expandable tubular member 1100, a sealing channel is defined between the flange member 1104 and the flange channel 1204 and the wave spring resilient member 1404a is positioned in the sealing channel, as illustrated in Fig. 14b and 14c. With the expandable tubular member 1100 coupled to the expandable tubular member 1200, an expandable tubular member 1404b is provided.

[0132] Referring now to Figs. 1, 14a, 14d, and 14e, the method 1400 then proceeds to step 1406 where the expandable tubular members 1100 and 1200 are positioned in the wellbore 100. The expandable tubular member 1404b is positioned in the passageway 104 of wellbore 100 such that outer surfaces 1102a and 1202a of the expandable tubular members 1100 and 1200, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 14d.

[0133] The method 1400 proceeds to step 1408 where the expandable tubular members 1100 and 1200 are radially expanded and plastically deformed. An expansion device 1408a which is coupled to a drill string 1408b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 1100 and 1200. The expansion device 1408a is positioned in the expandable tubular member 1404b and moved in a direction F, as illustrated in Fig. 14d. Movement of the expansion device 1408a in direction F expands the expandable tubular members 1100 and 1200 such that the outer surfaces 1102a and 1202a, respectively, engage the passageway surface 104a of the wellbore 100. In an exemplary embodiment, the expansion device 1408a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Furthermore, the expansion of the expandable tubular member 1404b adjacent the flange member 1104 and the flange channel 1204 results in the deformation of the wave spring resilient member 1404a. Deformation of the wave spring resilient member 1404a provides a gas and liquid tight seal between the expandable tubular members 1100 and 1200. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 1100 and 1200 is a metal to metal seal. Thus, a method and apparatus are provided which provide a gas and liquid tight seal between two expandable tubular members 1100 and 1200 which are coupled together and radially expanded and plastically deformed.

[0134] Referring now to Figs. 11, 12, 15a, 15b, and 15c, a method 1500 for coupling expandable tubular members is illustrated. The method 1500 begins at step 1502 where the expandable tubular members 1100 and 1200, illustrated in Figs. 11 and 12, are provided. The method 1500 then proceeds to step 1504 where the expandable tubular members 1100 and 1200 are coupled together. An O-ring resilient member 1504a is positioned in the flange channels 1204 and about the circumference of the expandable tubular member 1200. In an

exemplary embodiment, the O-ring resilient member 1504a is fabricated from a metal material.

[0135] The expandable tubular member 1100 is then coupled to the expandable tubular member 1200 by positioning the flange members 1104 in the flange channels 1204. In an exemplary embodiment, the flange members 1104 are positioned in the flange channels 1204 by heating the expandable tubular member 1100, causing the expandable tubular member 1100 to expand, which increases the diameter of the passageway 1102d and allows the distal end of expandable tubular member 1200 to be positioned in the passageway 1102d of the expandable tubular member 1100. In an exemplary embodiment, the flange members 1104 are positioned in the flange channels 1204 by forcing the distal end of expandable tubular member 1200 into the passageway 1102d of the expandable tubular member 1100, causing the expandable tubular member 1100 to elastically deform to allow the distal end of expandable tubular member 1200 to be positioned in the passageway 1102d of the expandable tubular member 1100. In an exemplary embodiment, the flange members 1104 are conventional thread members known in the art and the flange channels 1204 are conventional thread channels known in the art, and the flange members 1104 are positioned in the flange channels 1204 by threading the thread members into the thread channels. In an exemplary embodiment, the flange members 1104 may be positioned in the flange channels 1204 using a variety of other conventional methods known in the art.

[0136] With the expandable tubular member 1200 coupled to the expandable tubular member 1100, a sealing channel is defined between the flange member 1104 and the flange channel 1204 and the O-ring resilient member 1504a is positioned in the sealing channel, as illustrated in Fig. 15b and 15c. With the expandable tubular member 1100 coupled to the expandable tubular member 1200, an expandable tubular member 1504b is provided.

[0137] Referring now to Figs. 1, 15a, 15d, and 15e, the method 1500 then proceeds to step 1506 where the expandable tubular members 1100 and 1200 are positioned in the wellbore 100. The expandable tubular member 1504b is positioned in the passageway 104 of wellbore 100 such that outer surfaces 1102a and 1202a of the expandable tubular members 1100 and 1200, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 15d. The method 1500 proceeds to step 1508 where the expandable tubular members 1100 and 1200 are radially expanded and plastically deformed. An expansion device 1508a which is coupled to a drill string 1508b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 1100 and 1200. The expansion device 1508a is positioned in the expandable tubular member 1504b and moved in a direction G, as illustrated in Fig. 15d. Movement of the expansion device 1508a in direction G expands the expandable tubular members 1100 and 1200 such that the outer surfaces 1102a and 1202a, respectively, engage the passageway surface 104a of the

wellbore 100. In an exemplary embodiment, the expansion device 1508a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Furthermore, the expansion of the expandable tubular member 1504b adjacent the flange member 1104 and the flange channel 1204 results in the deformation of the O-ring resilient member 1504a. Deformation of the O-ring resilient member 1504a provides a gas and liquid tight seal between the expandable tubular members 1100 and 1200. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 1100 and 1200 is a metal to metal seal. Thus, a method and apparatus are provided which provide a gas and liquid tight seal between two expandable tubular members 1100 and 1200 which are coupled together and radially expanded and plastically deformed.

[0138] Referring now to Fig. 16, an expandable tubular member 1600 is illustrated. The expandable tubular member 1600 includes a tubular base 1602 having an outer surface 1602a, and inner surface 1602b located opposite the outer surface 1602a, a distal end 1602c, and defining a passageway 1602d extending along its length of the tubular base 1602 to the distal end 1602c. A plurality of flange members 1604 extend from the inner surface 1602b of the tubular base 1602 and into the passageway 1602d, each flange member 1604 including a resilient beam 1604a extending from a distal end of the flange member 1604 at an angle with respect to the flange member 1604 and into the passageway 1602d. In an exemplary embodiment, the expandable tubular member 1600 is fabricated from a metal material.

[0139] Referring now to Figs. 12, 16, 17a, 17b, and 17c, a method 1700 for coupling expandable tubular members is illustrated. The method 1700 begins at step 1702 where the expandable tubular members 1200 and 1600, illustrated in Figs. 12 and 16, are provided.

[0140] The method 1700 then proceeds to step 1704 where the expandable tubular members 1200 and 1600 are coupled together. The expandable tubular member 1600 is coupled to the expandable tubular member 1200 by positioning the flange members 1604 in the flange channels 1204. In an exemplary embodiment, the flange members 1604 are positioned in the flange channels 1204 by heating the expandable tubular member 1100, causing the expandable tubular member 1100 to expand, which increases the diameter of the passageway 1602d and allows the distal end of expandable tubular member 1200 to be positioned in the passageway 1602d of the expandable tubular member 1600. In an exemplary embodiment, the flange members 1604 are positioned in the flange channels 1204 by forcing the distal end of expandable tubular member 1200 into the passageway 1602d of the expandable tubular member 1600, causing the expandable tubular member 1600 to elastically deform to allow the distal end of expandable tubular member 1200 to be positioned in the passageway 1602d of the expandable tubular member 1100. In an

exemplary embodiment, the flange members 1604 are conventional thread members known in the art and the flange channels 1204 are conventional thread channels known in the art, and the flange members 1604 are positioned in the flange channels 1204 by threading the thread members into the thread channels. In an exemplary embodiment, the flange members 1604 may be positioned in the flange channels 1204 using a variety of other conventional methods known in the art. With the expandable tubular member 1600 coupled to the expandable tubular member 1200, a sealing channel is defined between the flange member 1604 and the flange channel 1204 and the resilient beam 1604a is positioned in the sealing channel, as illustrated in Fig. 17b and 17c. With the expandable tubular member 1600 coupled to the expandable tubular member 1200, an expandable tubular member 1704a is provided.

[0141] Referring now to Figs. 1, 17a, 17d, and 17e, the method 1700 then proceeds to step 1706 where the expandable tubular members 1200 and 1600 are positioned in the wellbore 100. The expandable tubular member 1704a is positioned in the passageway 104 of wellbore 100 such that outer surfaces 1202a and 1602a of the expandable tubular members 1200 and 1600, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 17d.

[0142] The method 1700 proceeds to step 1708 where the expandable tubular members 1200 and 1600 are radially expanded and plastically deformed. An expansion device 1708a which is coupled to a drill string 1708b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 1200 and 1600. The expansion device 1708a is positioned in the expandable tubular member 1704a and moved in a direction H, as illustrated in Fig. 17d. Movement of the expansion device 1708a in direction H expands the expandable tubular members 1200 and 1600 such that the outer surfaces 1202a and 1602a, respectively, engage the passageway surface 104a of the wellbore 100. In an exemplary embodiment, the expansion device 1708a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art. Furthermore, the expansion of the expandable tubular member 1704a adjacent the flange member 1604 and the flange channel 1204 results in the deformation of the resilient beam 1604a. Deformation of the resilient beam 1604a provides a gas and liquid tight seal between the expandable tubular members 1200 and 1600. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 1200 and 1600 is a metal to metal seal. Thus, a method and apparatus are provided which provide a gas and liquid tight seal between two expandable tubular members 1200 and 1600 which are coupled together and radially expanded and plastically deformed.

[0143] Referring now to Fig. 18, an expandable tubular member 1800 is illustrated. The

expandable tubular member 1800 includes a tubular base 1802 having an outer surface 1802a, and inner surface 1802b located opposite the outer surface 1802a, a distal end 1802c, and defining a passageway 1802d extending along its length of the tubular base 1802 to the distal end 1802c. A secondary sealing surface 1804 is defined by the tubular base 1802 and is located on the outer surface 1802a and adjacent the distal end 1802c. A beveled primary sealing surface 1806 is defined by the tubular base 1802 and is located on the inner surface 1802b and adjacent the distal end 1802c. In an exemplary embodiment, the expandable tubular member 1800 is fabricated from a metal material.

[0144] Referring now to Fig. 19, an expandable tubular member 1900 is illustrated. The expandable tubular member 1900 includes a tubular base 1902 having an outer surface 1902a, and inner surface 1902b located opposite the outer surface 1902a, a distal end 1902c, and defining a passageway 1902d extending along its length of the tubular base 1902 to the distal end 1902c. A secondary sealing surface 1904 is defined by the tubular base 1902 and is located on the outer surface 1902a and adjacent the distal end 1902c. A beveled primary sealing surface 1906 is defined by the tubular base 1902 and is located on the inner surface 1902b and adjacent the distal end 1902c. In an exemplary embodiment, the expandable tubular member 1900 is fabricated from a metal material.

[0145] Referring now to Fig. 20, a connection member 2000 is illustrated. Connection member 2000 includes a tubular base member 2002 having an outer surface 2002a, and inner surface 2002b located opposite the outer surface 2002a, a pair of opposing distal ends 2002c and 2002d, and defining a passageway 2002e along the length of the tubular base member 2002 from distal end 2002c to distal end 2002d. The tubular base member 2002 defines a plurality of secondary sealing surfaces 2004 on the inner surface 2002b adjacent the distal ends 2002c and 200d and on the distal ends 2002c and 2002d. A primary sealing member 2006 having a substantially diamond shaped cross section extends from the inner surface 2002b, centrally located between the distal ends 2002c and 2002d of the tubular base member 2002, and into the passageway 2002e. A reinforcing member 2008 is located on the outer surface 2002a radially adjacent the primary sealing member 2006 on tubular base member 2002, and provides a circumferential section of the connection member 2000 located adjacent the primary sealing member 2006 which is thicker than the rest of the connection member 2000 in order assist in the plastic deformation for the primary sealing member 2006. In an exemplary embodiment, the connection member 2000 is fabricated from a metal material.

[0146] Referring now to Figs. 18, 19, 20, 21a, 21b, and 21c, a method 2100 for coupling expandable tubular members is illustrated. The method 2100 begins at step 2102 where the expandable tubular members 1800 and 1900, illustrated in Figs. 18 and 19, and the connection member 2000, illustrated in Fig. 20, are provided. The method 2100 then

proceeds to step 2104 where the expandable tubular members 1800 and 1900 are coupled together. The connection member 2000 is positioned between the expandable tubular members 1800 and 1900 such that the distal end 2002d on connection member 2000 is adjacent the distal end 1902c on expandable tubular member 1900 and the distal end 2002c on connection member 2000 is adjacent the distal end 1802c on expandable tubular member 1900. The expandable tubular members 1800 and 1900 are then engaged with the connection member 2000 such that the beveled primary sealing surfaces 1806 and 1906, respectively, engage the primary sealing member 2006 on connection member 2000. A coupling member 2104a is them provided between the secondary sealing surfaces 1804 and 1904 on expandable tubular members 1800 and 1900, respectively, and the secondary sealing surfaces 2004 on the connection member 2000, as illustrated in Figs. 21b and 21c. In an exemplary embodiment, the coupling member 2104a may be a variety of coupling members known in the art such as, for example, a weld.

[0147] Referring now to Figs. 1, 21a, 21d, and 21e, the method 2100 then proceeds to step 2106 where the expandable tubular members 1800 and 1900 are positioned in the wellbore 100. The expandable tubular member 2104b is positioned in the passageway 104 of wellbore 100 such that outer surfaces 1802a and 1902a of the expandable tubular members 1800 and 1900, respectively, are positioned adjacent the passageway surface 104a, as illustrated in Fig. 21d.

[0148] The method 2100 proceeds to step 2108 where the expandable tubular members 1800 and 1900 are radially expanded and plastically deformed. An expansion device 2108a which is coupled to a drill string 2108b is provided which has larger outside diameter than the inside diameters of the expandable tubular members 1800 and 1900. The expansion device 2108a is positioned in the expandable tubular member 2104b and moved in a direction I, as illustrated in Fig. 21d. Movement of the expansion device 2108a in direction I expands the expandable tubular members 1800 and 1900 such that the outer surfaces 1802a and 1902a, respectively, engage the passageway surface 104a of the wellbore 100. In an exemplary embodiment, the expansion device 2108a may be a fixed diameter expansion device, a rotary expansion device, a hydroforming device, combinations thereof, and/or a variety of other expansion devices known in the art.

[0149] Furthermore, the expansion of the connection member 2000 deforms the coupling member 2104a against the secondary sealing surfaces 1804, 1904, and 2004, and deforms the primary sealing member 2006 again the primary sealing surfaces 1806 and 1906, as illustrated in Fig. 21e, which results in a gas and liquid tight seal between the expandable tubular members 1800 and 1900 and the connection member 2000. In an exemplary embodiment, the gas and liquid tight seal provided between the expandable tubular members 1800 and 1900 and the connection member 2000 is a metal to metal seal. Thus, a

method and apparatus are provided which provide a gas and liquid tight seal between two expandable tubular members 1800 and 1900 which are coupled together and radially expanded and plastically deformed.

[0150] An expandable tubular member has been described that includes a first tubular member comprising a first tubular member diameter which decreases from a first outside diameter along the length of the first tubular member to a second outside diameter adjacent a first tubular member connection end on the first tubular member, a second tubular member comprising a second tubular member diameter which decreases from a third outside diameter along the length of the second tubular member to a fourth outside diameter adjacent a second tubular member connection end on the second tubular member, whereby the second tubular member connection end is positioned adjacent the first tubular member connection end, and a connection member coupled to the second outside diameter and the fourth outside diameter, whereby the connection member comprises a connection member diameter which is not substantially greater than the first outside diameter and the third outside diameter. In an exemplary embodiment, the first outside diameter is substantially equal to the third outside diameter. In an exemplary embodiment, the second outside diameter is substantially equal to the fourth outside diameter. In an exemplary embodiment, the connection member diameter is less than or equal to the first outside diameter and the third outside diameter. In an exemplary embodiment, the connection member diameter is less than the first outside diameter and the third outside diameter. In an exemplary embodiment, the first tubular member connection end is coupled the second tubular member connection end. In an exemplary embodiment, a protective sleeve is coupled to the connection member. In an exemplary embodiment, the first tubular member, the second tubular member, and the connection member are positioned in a wellbore.

[0151] An expandable tubular member has been described that includes a first tubular member comprising a maximum first tubular member diameter, a second tubular member comprising a maximum second tubular member diameter, whereby the second tubular member is positioned adjacent the first tubular member, and means for allowing a connection member to be coupled to the first tubular member and the second tubular without a maximum connection member diameter being substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter.

[0152] An expandable tubular member has been described that includes a tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, and an expansion channel defined by the tubular member and located on the outer surface and adjacent the thread member. In an exemplary embodiment, a plurality of thread members extend from the inner surface, and an expansion channel is defined by the tubular member and located on the outer surface and adjacent each of the plurality of thread

members. In an exemplary embodiment, the expansion channel is located radially adjacent the thread member. In an exemplary embodiment, the expansion channel comprises a helical channel on the outer surface of the tubular member. In an exemplary embodiment, the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

[0153] An expandable tubular member has been described that includes a tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, and means for providing a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member. In an exemplary embodiment, the means for providing a stress concentration comprises a helical groove on the outer surface of the tubular member. In an exemplary embodiment, the means for providing a stress concentration comprises means for providing a stress concentration along the length of the thread member.

[0154] An expandable tubular member has been described that includes a first tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, an expansion channel defined by the first tubular member and located on the outer surface and adjacent the thread member, and a second tubular member coupled the first tubular member and engaging the thread member. In an exemplary embodiment, a plurality of thread members extend from the inner surface, whereby the second tubular member is coupled to the first tubular member and engaging the plurality of thread members, and an expansion channel is defined by the first tubular member and located on the outer surface and adjacent each of the plurality of thread members. In an exemplary embodiment, the expansion channel is located radially adjacent the thread member. In an exemplary embodiment, the first tubular member and the second tubular member are positioned in a wellbore. In an exemplary embodiment, the expansion channel comprises a helical channel on the outer surface of the first tubular member. In an exemplary embodiment, the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member. In an exemplary embodiment, a tubular connection sleeve is positioned on the first tubular member, and an expansion slot is defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel. In an exemplary embodiment, the expansion slot is oriented substantially perpendicularly with respect to the expansion channel. In an exemplary embodiment, a plurality of spaced apart expansion slots are defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel. In an exemplary embodiment, the plurality of spaced apart expansion slots are oriented substantially perpendicularly with respect to the expansion channel. In an

exemplary embodiment, the plurality of spaced apart expansion slots are spaced apart about the circumference of the tubular connection sleeve. In an exemplary embodiment, the first tubular member the second tubular member, and the tubular connection sleeve are positioned in a wellbore. In an exemplary embodiment, the expansion slot on the tubular connection sleeve provides at least one discrete point stress concentration on the thread member during radial expansion and plastic deformation of the first tubular member.

[0155] An expandable tubular member has been described that includes a first tubular member comprising an inner surface and an outer surface, a thread member extending from the inner surface, an expansion channel defined by the first tubular member and located on the outer surface and adjacent the thread member, a tubular connection sleeve positioned on the first tubular member, an expansion slot defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel, and a second tubular member coupled the first tubular member and engaging the thread member, whereby upon radial expansion and plastic deformation of the first tubular member and the second tubular member, the first tubular member and the second tubular member can withstand a pressure of up to approximately 4000 pounds per square inch.

[0156] An expandable tubular member has been described that includes a first tubular member defining a flange channel on a first surface of the first tubular member, and resilient means positioned in the flange channel for forming a seal between the first tubular member and a second tubular member. In an exemplary embodiment, the resilient means for forming a seal comprises means for forming a metal to metal seal. In an exemplary embodiment, the resilient means comprises a wave spring. In an exemplary embodiment, the resilient means comprises an O-ring.

[0157] An expandable tubular member has been described that includes a first tubular member comprising a flange member extending from a surface on the first tubular member, the flange member comprising a resilient beam extending from a distal end of the flange member for forming a seal between the first tubular member and a second tubular member.

[0158] An expandable tubular member has been described that includes a first tubular member defining a flange channel on a surface of the first tubular member, a second tubular member comprising a flange member extending from a surface on the second tubular member, the second tubular member coupled to the first tubular member with the flange member positioned in the flange channel, whereby a sealing passageway is defined between the flange member and the flange channel, and resilient means for forming a seal between the first tubular member and the second tubular member positioned in the sealing passageway. In an exemplary embodiment, the resilient means for forming a seal comprises means for forming a metal to metal seal. In an exemplary embodiment, the

resilient member comprises a wave spring. In an exemplary embodiment, the wave spring is positioned in the sealing passageway and circumferentially between the flange member and the flange channel. In an exemplary embodiment, the first tubular member, the second tubular member, and the wave spring are positioned in a wellbore. In an exemplary embodiment, the resilient member comprises an O-ring. In an exemplary embodiment, the O-ring is positioned in the sealing passageway and circumferentially between the flange member and the flange channel. In an exemplary embodiment, the first tubular member, the second tubular member, and the O-ring are positioned in a wellbore. In an exemplary embodiment, the resilient member comprises a resilient beam extending from a distal end of the flange member. In an exemplary embodiment, the resilient beam is located in the sealing passageway and circumferentially between the flange member and the flange channel. In an exemplary embodiment, the first tubular member, the second tubular member, and the resilient beam are positioned in a wellbore.

[0159] A connection member for coupling expandable tubular members has been described that includes a tubular connection member comprising an inner surface and an outer surface, a primary sealing member having a substantially diamond shaped cross section and extending from a substantially central location on the inner surface, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member. In an exemplary embodiment, the primary sealing member is deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member. In an exemplary embodiment, the plurality of secondary sealing surfaces are deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member.

[0160] A connection member for coupling expandable tubular members has been described that includes a tubular connection member, and means for providing a primary and secondary metal to metal seal between the tubular connection member and an expandable tubular member.

[0161] An expandable tubular member has been described that includes a first tubular member comprising a first connection end, a second tubular member comprising a second connection end, and a connection member coupling together the first tubular member and the second tubular member, the connection member including a tubular connection member comprising an inner surface and an outer surface, the inner surface engaging the first tubular member and the second tubular member, a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, and positioned between the first connection end and the second connection end, a

reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member, the secondary sealing surfaces coupled to the first connection end and the second connection end. In an exemplary embodiment, the primary sealing member is deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member. In an exemplary embodiment, the plurality of secondary sealing surfaces are deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member. In an exemplary embodiment, the first tubular member, the second tubular member, and the connection member are positioned in a wellbore.

[0162] An expandable tubular member has been described that includes a first tubular member comprising a first connection end, a second tubular member comprising a second connection end, a connection member coupled to the first connection end and the second connection end, and means for providing a primary and secondary metal to metal seal between the connection member and the first tubular member and the second tubular member.

[0163] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a maximum first tubular member diameter, providing a second tubular comprising a maximum second tubular member diameter, and coupling the first tubular member to the second tubular member with a connection member comprising a maximum connection member diameter which is not substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter. In an exemplary embodiment, the method further includes coupling a protective sleeve adjacent the connection member. In an exemplary embodiment, the method further includes positioning the first tubular member, the second tubular member, and the connection member in a wellbore. In an exemplary embodiment, the method further includes radially expanding and plastically deforming the first tubular member and the second tubular member. In an exemplary embodiment, the radially expanding and plastically deforming comprises radially expanding and plastically deforming a first reduced diameter section on the first tubular member to substantially the maximum first tubular member diameter and radially expanding and plastically deforming a second reduced diameter section on the second tubular member to substantially the maximum second tubular member diameter. In an exemplary embodiment, the radially expanding and plastically deforming comprises radially expanding and plastically deforming the first tubular member and the second tubular member into engagement with the wellbore.

[0164] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a thread member extending from an inner surface and defining a expansion channel on the outer surface which is located adjacent the thread member, and coupling a second tubular member to the first tubular member by engaging the thread member with a thread channel in the second tubular member. In an exemplary embodiment, the method further includes positioning the first tubular member and the second tubular member in a wellbore. In an exemplary embodiment, the method further includes radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the expansion channel provides a stress concentration in the thread member which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming. In an exemplary embodiment, the radially expanding and plastically deforming provides a metal to metal seal between the thread member and the thread channel. In an exemplary embodiment, the method further includes coupling a connection sleeve to the outer surface of the of the first tubular member, the connection sleeve defining an expansion slot oriented axially with respect the connection sleeve and which is positioned substantially perpendicularly to the expansion channel. In an exemplary embodiment, the method further includes positioning the first tubular member, the second tubular member, and the connection sleeve in a wellbore. In an exemplary embodiment, the method further includes radially expanding and plastically deforming the first tubular member, the second tubular member, and the connection sleeve, whereby the expansion slot and the expansion channel provide a stress concentration which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming. In an exemplary embodiment, the radially expanding and plastically deforming provides a metal to metal seal between the thread member and the thread channel.

[0165] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a flange member extending from an inner surface, providing a second tubular member defining a flange channel on an outer surface, positioning a resilient member in the flange channel, and coupling the first tubular member to the second tubular member by positioning the flange member in the flange channel and adjacent the resilient member. In an exemplary embodiment, the method further includes positioning the first tubular member and the second tubular member in a wellbore. In an exemplary embodiment, the method further includes radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming compresses the resilient member and provides a seal between the flange member and the flange channel. In an exemplary embodiment, the radially expanding and plastically deforming provides a metal to metal seal between the

flange member and the flange channel.

[0166] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a first connection end, providing a second tubular member comprising a second connection end, positioning a connection member adjacent the first connection end and the second connection end such that a primary sealing member on the connection member is positioned between the first connection end and the second connection end, and a plurality of secondary sealing surfaces are positioned adjacent the first tubular member and the second tubular member, and coupling the first tubular member to the second tubular member using the connection member. In an exemplary embodiment, the coupling includes providing a metal sealing member between the first tubular member, the second tubular member, and the secondary sealing surfaces. In an exemplary embodiment, the method further includes positioning the first tubular member, the second tubular member, and the connection member in a wellbore. In an exemplary embodiment, the method further includes radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming provides a primary seal between the primary sealing member and the first tubular member and the second tubular member, and the radially expanding and plastically deforming provides a secondary seal between the secondary sealing surfaces and the first tubular member and the second tubular member.

[0167] An expandable tubular member has been described that includes a first tubular member, a second tubular member coupled to the first tubular member, and means for effecting a gas and fluid tight seal between the first tubular member and the second tubular member before, during, and after radial expansion and plastic deformation of the first tubular member and the second tubular member, the means providing a seal which can withstand a pressure of up to 4000 pounds per square inch.

[0168] An expandable tubular member has been described that includes a first tubular member comprising a first tubular member diameter which decreases from a first outside diameter along the length of the first tubular member to a second outside diameter adjacent a first tubular member connection end on the first tubular member, a second tubular member comprising a second tubular member diameter which decreases from first outside diameter along the length of the second tubular member to the second outside diameter adjacent a second tubular member connection end on the second tubular member, whereby the second tubular member connection end is coupled to the first tubular member connection end, and a connection member coupled to the second outside diameter, whereby the connection member comprises a connection member diameter which is less than or equal to the first outside diameter.

[0169] An expandable tubular member has been described that includes a tubular member

comprising an inner surface and an outer surface, a plurality of thread members extending from the inner surface, and a helical expansion channel defined by the tubular member and located on the outer surface and radially adjacent each of the plurality of thread members, whereby the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

[0170] An expandable tubular member has been described that includes a first tubular member comprising an inner surface and an outer surface, a plurality of thread member extending from the inner surface, a helical expansion channel defined by the first tubular member and located on the outer surface and radially adjacent each of the plurality of thread members, a second tubular member coupled the first tubular member and engaging the plurality of thread members, whereby the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the first tubular member and the second tubular member, a tubular connection sleeve positioned on the first tubular member, and a plurality of spaced apart expansion slots defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and oriented substantially perpendicularly adjacent to and with respect to the expansion channel; whereby the plurality of expansion slots on the tubular connection sleeve provides a plurality of discrete point stress concentrations on the thread member during radial expansion and plastic deformation of the first tubular member, the second tubular member, and the connection sleeve.

[0171] A connection member for coupling expandable tubular members has been described that includes a tubular connection member comprising an inner surface and an outer surface, a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, and deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member on opposite sides of the primary sealing member, and deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member.

[0172] An expandable tubular member has been described that includes a first tubular member comprising a first connection end, a second tubular member comprising a second connection end, and a connection member coupling together the first tubular member and the second tubular member, the connection member including a tubular connection member comprising an inner surface and an outer surface, the inner surface engaging the first tubular member and the second tubular member, a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner

surface, positioned between the first connection end and the second connection end, and deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member, a reinforced section located on the outer surface and adjacent the primary sealing member, and a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member, the secondary sealing surfaces coupled to the first connection end and the second connection end and deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member.

[0173] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a maximum first tubular member diameter, providing a second tubular comprising a maximum second tubular member diameter, coupling the first tubular member to the second tubular member with a connection member comprising a maximum connection member diameter which is not substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter, positioning the first tubular member, the second tubular member, and the connection member in a wellbore, and radially expanding and plastically deforming the first tubular member and the second tubular member, wherein the radially expanding and plastically deforming comprises one of either radially expanding and plastically deforming a first reduced diameter section on the first tubular member to substantially the maximum first tubular member diameter and radially expanding and plastically deforming a second reduced diameter section on the second tubular member to substantially the maximum second tubular member diameter or radially expanding and plastically deforming the first tubular member and the second tubular member into engagement with the wellbore.

[0174] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a thread member extending from an inner surface and defining a expansion channel on the outer surface which is located adjacent the thread member, coupling a connection sleeve to the outer surface of the of the first tubular member, the connection sleeve defining an expansion slot oriented axially with respect the connection sleeve and which is positioned substantially perpendicularly to the expansion channel, coupling a second tubular member to the first tubular member by engaging the thread member with a thread channel in the second tubular member, positioning the first tubular member, the second tubular member, and the connection sleeve in a wellbore, and radially expanding and plastically deforming the first tubular member, the second tubular member, and the connection sleeve, whereby the expansion slot and the expansion channel provide a stress concentration which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming

and provides a metal to metal seal between the thread member and the thread channel.

[0175] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a flange member extending from an inner surface, providing a second tubular member defining a flange channel on an outer surface, positioning a resilient member in the flange channel, coupling the first tubular member to the second tubular member by positioning the flange member in the flange channel and adjacent the resilient member, positioning the first tubular member and the second tubular member in a wellbore, and radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming compresses the resilient member and provides a seal between the flange member and the flange channel; whereby the radially expanding and plastically deforming provides a metal to metal seal between the flange member and the flange channel.

[0176] A method for coupling expandable tubular members has been described that includes providing a first tubular member comprising a first connection end, providing a second tubular member comprising a second connection end, positioning a connection member adjacent the first connection end and the second connection end such that a primary sealing member on the connection member is positioned between the first connection end and the second connection end, and a plurality of secondary sealing surfaces are positioned adjacent the first tubular member and the second tubular member, coupling the first tubular member to the second tubular member using the connection member, whereby the coupling includes providing a metal sealing member between the first tubular member, the second tubular member, and the secondary sealing surfaces, positioning the first tubular member, the second tubular member, and the connection member in a wellbore, and radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming provides a primary seal between the primary sealing member and the first tubular member and the second tubular member, and the radially expanding and plastically deforming provides a secondary seal between the secondary sealing surfaces and the first tubular member and the second tubular member.

[0177] It is understood that variations may be made in the foregoing without departing from the scope of the invention. Furthermore, the elements and teachings of the various illustrative embodiments may be combined in whole or in part in some or all of the illustrative embodiments. In addition, one or more of the elements and teachings of the various illustrative embodiments may be omitted, at least in part, and/or combined, at least in part, with one or more of the other elements and teachings of the various illustrative embodiments.

[0178] Although illustrative embodiments of the invention have been shown and described, a wide range of modification, changes and substitution is contemplated in the foregoing disclosure. In some instances, some features of the present invention may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

Claims

What is claimed is:

1. An expandable tubular member, comprising:

a first tubular member comprising a first tubular member diameter which decreases from a first outside diameter along the length of the first tubular member to a second outside diameter adjacent a first tubular member connection end on the first tubular member;

a second tubular member comprising a second tubular member diameter which decreases from a third outside diameter along the length of the second tubular member to a fourth outside diameter adjacent a second tubular member connection end on the second tubular member, whereby the second tubular member connection end is positioned adjacent the first tubular member connection end; and

a connection member coupled to the second outside diameter and the fourth outside diameter, whereby the connection member comprises a connection member diameter which is not substantially greater than the first outside diameter and the third outside diameter.

2. The expandable tubular member of claim 1, wherein the first outside diameter is substantially equal to the third outside diameter.

3. The expandable tubular member of claim 1, wherein the second outside diameter is substantially equal to the fourth outside diameter.

4. The expandable tubular member of claim 1, wherein the connection member diameter is less than or equal to the first outside diameter and the third outside diameter.

5. The expandable tubular member of claim 1, wherein the connection member diameter is less than the first outside diameter and the third outside diameter.

6. The expandable tubular member of claim 1, wherein the first tubular member connection end is coupled the second tubular member connection end.

7. The expandable tubular member of claim 1, further comprising:

a protective sleeve coupled to the connection member.

8. The expandable tubular member of claim 1, wherein the first tubular member, the

second tubular member, and the connection member are positioned in a wellbore.

9. An expandable tubular member, comprising:

a first tubular member comprising a maximum first tubular member diameter;

a second tubular member comprising a maximum second tubular member diameter, whereby the second tubular member is positioned adjacent the first tubular member; and

means for allowing a connection member to be coupled to the first tubular member and the second tubular without a maximum connection member diameter being substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter.

10. An expandable tubular member, comprising:

a tubular member comprising an inner surface and an outer surface;

a thread member extending from the inner surface; and

an expansion channel defined by the tubular member and located on the outer surface and adjacent the thread member.

11. The expandable tubular member of claim 10, further comprising:

a plurality of thread members extending from the inner surface; and

an expansion channel defined by the tubular member and located on the outer surface and adjacent each of the plurality of thread members.

12. The expandable tubular member of claim 10, wherein the expansion channel is located radially adjacent the thread member.

13. The expandable tubular member of claim 10, wherein the expansion channel comprises a helical channel on the outer surface of the tubular member.

14. The expandable tubular member of claim 10, wherein the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

15. An expandable tubular member, comprising:

a tubular member comprising an inner surface and an outer surface;

a thread member extending from the inner surface; and

means for providing a stress concentration in the thread member during radial

expansion and plastic deformation of the tubular member.

16. The expandable tubular member of claim 15, wherein the means for providing a stress concentration comprises a helical groove on the outer surface of the tubular member.

17. The expandable tubular member of claim 15, wherein the means for providing a stress concentration comprises means for providing a stress concentration along the length of the thread member.

18. An expandable tubular member, comprising:

a first tubular member comprising an inner surface and an outer surface;

a thread member extending from the inner surface;

an expansion channel defined by the first tubular member and located on the outer surface and adjacent the thread member; and

a second tubular member coupled the first tubular member and engaging the thread member.

19. The expandable tubular member of claim 18, further comprising:

a plurality of thread members extending from the inner surface, whereby the second tubular member is coupled to the first tubular member and engaging the plurality of thread members; and

an expansion channel defined by the first tubular member and located on the outer surface and adjacent each of the plurality of thread members.

20. The expandable tubular member of claim 18, wherein the expansion channel is located radially adjacent the thread member.

21. The expandable tubular member of claim 18, wherein the first tubular member and the second tubular member are positioned in a wellbore.

22. The expandable tubular member of claim 18, wherein the expansion channel comprises a helical channel on the outer surface of the first tubular member.

23. The expandable tubular member of claim 18, wherein the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

24. The expandable tubular member of claim 18, further comprising:

a tubular connection sleeve positioned on the first tubular member; and

an expansion slot defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel.

25. The expandable tubular member of claim 24, wherein the expansion slot is oriented substantially perpendicularly with respect to the expansion channel.

26. The expandable tubular member of claim 24, further comprising:

a plurality of spaced apart expansion slots defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel.

27. The expandable tubular member of claim 26, wherein the plurality of spaced apart expansion slots are oriented substantially perpendicularly with respect to the expansion channel.

28. The expandable tubular member of claim 26, wherein the plurality of spaced apart expansion slots are spaced apart about the circumference of the tubular connection sleeve.

29. The expandable tubular member of claim 24, wherein the first tubular member the second tubular member, and the tubular connection sleeve are positioned in a wellbore.

30. The expandable tubular member of claim 24, wherein the expansion slot on the tubular connection sleeve provides at least one discrete point stress concentration on the thread member during radial expansion and plastic deformation of the first tubular member.

31. An expandable tubular member, comprising:

a first tubular member comprising an inner surface and an outer surface;

a thread member extending from the inner surface;

an expansion channel defined by the first tubular member and located on the outer surface and adjacent the thread member;

a tubular connection sleeve positioned on the first tubular member;

an expansion slot defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve and located adjacent the expansion channel; and

a second tubular member coupled the first tubular member and engaging the thread member, whereby upon radial expansion and plastic deformation of the first tubular member and the second tubular member, the first tubular member and the second tubular member can withstand a pressure of up to approximately 4000 pounds per square inch.

32. An expandable tubular member, comprising:

a first tubular member defining a flange channel on a first surface of the first tubular member; and

resilient means positioned in the flange channel for forming a seal between the first tubular member and a second tubular member.

33. The expandable tubular member of claim 32, wherein the resilient means for forming a seal comprises means for forming a metal to metal seal.

34. The expandable tubular member of claim 32, wherein the resilient means comprises a wave spring.

35. The expandable tubular member of claim 32, wherein the resilient means comprises an O-ring.

36. An expandable tubular member, comprising:

a first tubular member comprising a flange member extending from a surface on the first tubular member, the flange member comprising a resilient beam extending from a distal end of the flange member for forming a seal between the first tubular member and a second tubular member.

37. An expandable tubular member, comprising:

a first tubular member defining a flange channel on a surface of the first tubular member;

a second tubular member comprising a flange member extending from a surface on the second tubular member, the second tubular member coupled to the first tubular member with the flange member positioned in the flange channel, whereby a sealing passageway is defined between the flange member and the flange channel; and

resilient means for forming a seal between the first tubular member and the second tubular member positioned in the sealing passageway.

38. The expandable tubular member of claim 37, wherein the resilient means for forming a seal comprises means for forming a metal to metal seal.

39. The expandable tubular member of claim 37, wherein the resilient member comprises a wave spring.

40. The expandable tubular member of claim 39, wherein the wave spring is positioned in the sealing passageway and circumferentially between the flange member and the flange channel.

41. The expandable tubular member of claim 39, wherein the first tubular member, the second tubular member, and the wave spring are positioned in a wellbore.

42. The expandable tubular member of claim 37, wherein the resilient member comprises an O-ring.

43. The expandable tubular member of claim 42, wherein the O-ring is positioned in the sealing passageway and circumferentially between the flange member and the flange channel.

44. The expandable tubular member of claim 42, wherein the first tubular member, the second tubular member, and the O-ring are positioned in a wellbore.

45. The expandable tubular member of claim 37, wherein the resilient member comprises a resilient beam extending from a distal end of the flange member.

46. The expandable tubular member of claim 45, wherein the resilient beam is located in the sealing passageway and circumferentially between the flange member and the flange channel.

47. The expandable tubular member of claim 45, wherein the first tubular member, the second tubular member, and the resilient beam are positioned in a wellbore.

48. A connection member for coupling expandable tubular members, comprising:

a tubular connection member comprising an inner surface and an outer surface;

a primary sealing member having a substantially diamond shaped cross section and extending from a substantially central location on the inner surface;

a reinforced section located on the outer surface and adjacent the primary sealing member; and

a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing member.

49. The connection member of claim 48, wherein the primary sealing member is deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member.

50. The connection member of claim 48, wherein the plurality of secondary sealing surfaces are deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member.

51. A connection member for coupling expandable tubular members, comprising:

a tubular connection member; and

means for providing a primary and secondary metal to metal seal between the tubular connection member and an expandable tubular member.

52. An expandable tubular member, comprising:

a first tubular member comprising a first connection end;

a second tubular member comprising a second connection end; and

a connection member coupling together the first tubular member and the second tubular member, the connection member comprising:

a tubular connection member comprising an inner surface and an outer surface, the inner surface engaging the first tubular member and the second tubular member;

a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, and positioned between the first connection end and the second connection end;

a reinforced section located on the outer surface and adjacent the primary sealing member; and

a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing

member, the secondary sealing surfaces coupled to the first connection end and the second connection end.

53. The connection member of claim 52, wherein the primary sealing member is deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member.

54. The connection member of claim 52, wherein the plurality of secondary sealing surfaces are deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member.

55. The expandable tubular member of claim 52, wherein the first tubular member, the second tubular member, and the connection member are positioned in a wellbore.

56. An expandable tubular member, comprising:

a first tubular member comprising a first connection end;

a second tubular member comprising a second connection end;

a connection member coupled to the first connection end and the second connection end; and

means for providing a primary and secondary metal to metal seal between the connection member and the first tubular member and the second tubular member.

57. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a maximum first tubular member diameter;

providing a second tubular comprising a maximum second tubular member diameter; and

coupling the first tubular member to the second tubular member with a connection member comprising a maximum connection member diameter which is not substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter.

58. The method of claim 57, further comprising:

coupling a protective sleeve adjacent the connection member.

59. The method of claim 57, further comprising:

positioning the first tubular member, the second tubular member, and the

connection member in a wellbore.

60. The method of claim 59, further comprising:

radially expanding and plastically deforming the first tubular member and the second tubular member.

61. The method of claim 60, wherein the radially expanding and plastically deforming comprises radially expanding and plastically deforming a first reduced diameter section on the first tubular member to substantially the maximum first tubular member diameter and radially expanding and plastically deforming a second reduced diameter section on the second tubular member to substantially the maximum second tubular member diameter.

62. The method of claim 60, wherein the radially expanding and plastically deforming comprises radially expanding and plastically deforming the first tubular member and the second tubular member into engagement with the wellbore.

63. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a thread member extending from an inner surface and defining a expansion channel on the outer surface which is located adjacent the thread member; and

coupling a second tubular member to the first tubular member by engaging the thread member with a thread channel in the second tubular member.

64. The method of claim 63, further comprising:

positioning the first tubular member and the second tubular member in a wellbore.

65. The method of claim 64, further comprising:

radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the expansion channel provides a stress concentration in the thread member which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming.

66. The method of claim 65, wherein the radially expanding and plastically deforming provides a metal to metal seal between the thread member and the thread channel.

67. The method of claim 63, further comprising:

coupling a connection sleeve to the outer surface of the of the first tubular member, the connection sleeve defining an expansion slot oriented axially with respect the connection sleeve and which is positioned substantially perpendicularly to the expansion channel.

68. The method of claim 67, further comprising:

positioning the first tubular member, the second tubular member, and the connection sleeve in a wellbore.

69. The method of claim 68, further comprising:

radially expanding and plastically deforming the first tubular member, the second tubular member, and the connection sleeve, whereby the expansion slot and the expansion channel provide a stress concentration which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming.

70. The method of claim 69, wherein the radially expanding and plastically deforming provides a metal to metal seal between the thread member and the thread channel.

71. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a flange member extending from an inner surface;

providing a second tubular member defining a flange channel on an outer surface;

positioning a resilient member in the flange channel; and

coupling the first tubular member to the second tubular member by positioning the flange member in the flange channel and adjacent the resilient member.

72. The method of claim 71, further comprising:

positioning the first tubular member and the second tubular member in a wellbore.

73. The method of claim 72, further comprising:

radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming compresses the resilient member and provides a seal between the flange member and

the flange channel.

74. The method of claim 73, wherein the radially expanding and plastically deforming provides a metal to metal seal between the flange member and the flange channel.

75. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a first connection end;

providing a second tubular member comprising a second connection end;

positioning a connection member adjacent the first connection end and the second connection end such that a primary sealing member on the connection member is positioned between the first connection end and the second connection end, and a plurality of secondary sealing surfaces are positioned adjacent the first tubular member and the second tubular member; and

coupling the first tubular member to the second tubular member using the connection member.

76. The method of claim 75, wherein the coupling includes providing a metal sealing member between the first tubular member, the second tubular member, and the secondary sealing surfaces.

77. The method of claim 75, further comprising:

positioning the first tubular member, the second tubular member, and the connection member in a wellbore.

78. The method of claim 77, further comprising:

radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming provides a primary seal between the primary sealing member and the first tubular member and the second tubular member, and the radially expanding and plastically deforming provides a secondary seal between the secondary sealing surfaces and the first tubular member and the second tubular member.

79. An expandable tubular member, comprising:

a first tubular member;

a second tubular member coupled to the first tubular member; and

means for effecting a gas and fluid tight seal between the first tubular member and the second tubular member before, during, and after radial expansion and plastic

deformation of the first tubular member and the second tubular member, the means providing a seal which can withstand a pressure of up to 4000 pounds per square inch.

80. An expandable tubular member, comprising:

a first tubular member comprising a first tubular member diameter which decreases from a first outside diameter along the length of the first tubular member to a second outside diameter adjacent a first tubular member connection end on the first tubular member;

a second tubular member comprising a second tubular member diameter which decreases from first outside diameter along the length of the second tubular member to the second outside diameter adjacent a second tubular member connection end on the second tubular member, whereby the second tubular member connection end is coupled to the first tubular member connection end; and

a connection member coupled to the second outside diameter, whereby the connection member comprises a connection member diameter which is less than or equal to the first outside diameter.

81. An expandable tubular member, comprising:

a tubular member comprising an inner surface and an outer surface;

a plurality of thread members extending from the inner surface; and

a helical expansion channel defined by the tubular member and located on the outer surface and radially adjacent each of the plurality of thread members, whereby the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the tubular member.

82. An expandable tubular member, comprising:

a first tubular member comprising an inner surface and an outer surface;

a plurality of thread member extending from the inner surface;

a helical expansion channel defined by the first tubular member and located on the outer surface and radially adjacent each of the plurality of thread members;

a second tubular member coupled the first tubular member and engaging the plurality of thread members, whereby the expansion channel provides a stress concentration in the thread member during radial expansion and plastic deformation of the first tubular member and the second tubular member;

a tubular connection sleeve positioned on the first tubular member; and

a plurality of spaced apart expansion slots defined by the tubular connection sleeve in a substantially axial orientation with respect to the tubular connection sleeve

and oriented substantially perpendicularly adjacent to and with respect to the expansion channel; whereby the plurality of expansion slots on the tubular connection sleeve provides a plurality of discrete point stress concentrations on the thread member during radial expansion and plastic deformation of the first tubular member, the second tubular member, and the connection sleeve.

83. A connection member for coupling expandable tubular members, comprising:

a tubular connection member comprising an inner surface and an outer surface;

a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, and deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member;

a reinforced section located on the outer surface and adjacent the primary sealing member; and

a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member on opposite sides of the primary sealing member, and deformable to provide a metal to metal seal between the tubular connection member and an expandable tubular member.

84. An expandable tubular member, comprising:

a first tubular member comprising a first connection end;

a second tubular member comprising a second connection end; and

a connection member coupling together the first tubular member and the second tubular member, the connection member comprising:

a tubular connection member comprising an inner surface and an outer surface, the inner surface engaging the first tubular member and the second tubular member;

a primary sealing member having a substantially diamond shaped cross section, extending from a substantially central location on the inner surface, positioned between the first connection end and the second connection end, and deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member;

a reinforced section located on the outer surface and adjacent the primary sealing member; and

a plurality of secondary sealing surfaces located on opposite distal ends of the tubular connection member and on opposite sides of the primary sealing

member, the secondary sealing surfaces coupled to the first connection end and the second connection end and deformable to provide a metal to metal seal between the connection member and the first tubular member and the second tubular member.

85. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a maximum first tubular member diameter;

providing a second tubular comprising a maximum second tubular member diameter;

coupling the first tubular member to the second tubular member with a connection member comprising a maximum connection member diameter which is not substantially greater than the maximum first tubular member diameter and the maximum second tubular member diameter;

positioning the first tubular member, the second tubular member, and the connection member in a wellbore; and

radially expanding and plastically deforming the first tubular member and the second tubular member, wherein the radially expanding and plastically deforming comprises one of either radially expanding and plastically deforming a first reduced diameter section on the first tubular member to substantially the maximum first tubular member diameter and radially expanding and plastically deforming a second reduced diameter section on the second tubular member to substantially the maximum second tubular member diameter or radially expanding and plastically deforming the first tubular member and the second tubular member into engagement with the wellbore.

86. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a thread member extending from an inner surface and defining a expansion channel on the outer surface which is located adjacent the thread member;

coupling a connection sleeve to the outer surface of the of the first tubular member, the connection sleeve defining an expansion slot oriented axially with respect the connection sleeve and which is positioned substantially perpendicularly to the expansion channel;

coupling a second tubular member to the first tubular member by engaging the thread member with a thread channel in the second tubular member;

positioning the first tubular member, the second tubular member, and the connection sleeve in a wellbore; and

radially expanding and plastically deforming the first tubular member, the

second tubular member, and the connection sleeve, whereby the expansion slot and the expansion channel provide a stress concentration which increases the deformation of the thread member in the thread channel during the radially expanding and plastically deforming and provides a metal to metal seal between the thread member and the thread channel.

87. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a flange member extending from an inner surface;

providing a second tubular member defining a flange channel on an outer surface;

positioning a resilient member in the flange channel;

coupling the first tubular member to the second tubular member by positioning the flange member in the flange channel and adjacent the resilient member;

positioning the first tubular member and the second tubular member in a wellbore; and

radially expanding and plastically deforming the first tubular member and the second tubular member, whereby the radially expanding and plastically deforming compresses the resilient member and provides a seal between the flange member and the flange channel; whereby the radially expanding and plastically deforming provides a metal to metal seal between the flange member and the flange channel.

88. A method for coupling expandable tubular members, comprising:

providing a first tubular member comprising a first connection end;

providing a second tubular member comprising a second connection end;

positioning a connection member adjacent the first connection end and the second connection end such that a primary sealing member on the connection member is positioned between the first connection end and the second connection end, and a plurality of secondary sealing surfaces are positioned adjacent the first tubular member and the second tubular member;

coupling the first tubular member to the second tubular member using the connection member, whereby the coupling includes providing a metal sealing member between the first tubular member, the second tubular member, and the secondary sealing surfaces;

positioning the first tubular member, the second tubular member, and the connection member in a wellbore; and

radially expanding and plastically deforming the first tubular member and the

second tubular member, whereby the radially expanding and plastically deforming provides a primary seal between the primary sealing member and the first tubular member and the second tubular member, and the radially expanding and plastically deforming provides a secondary seal between the secondary sealing surfaces and the first tubular member and the second tubular member.

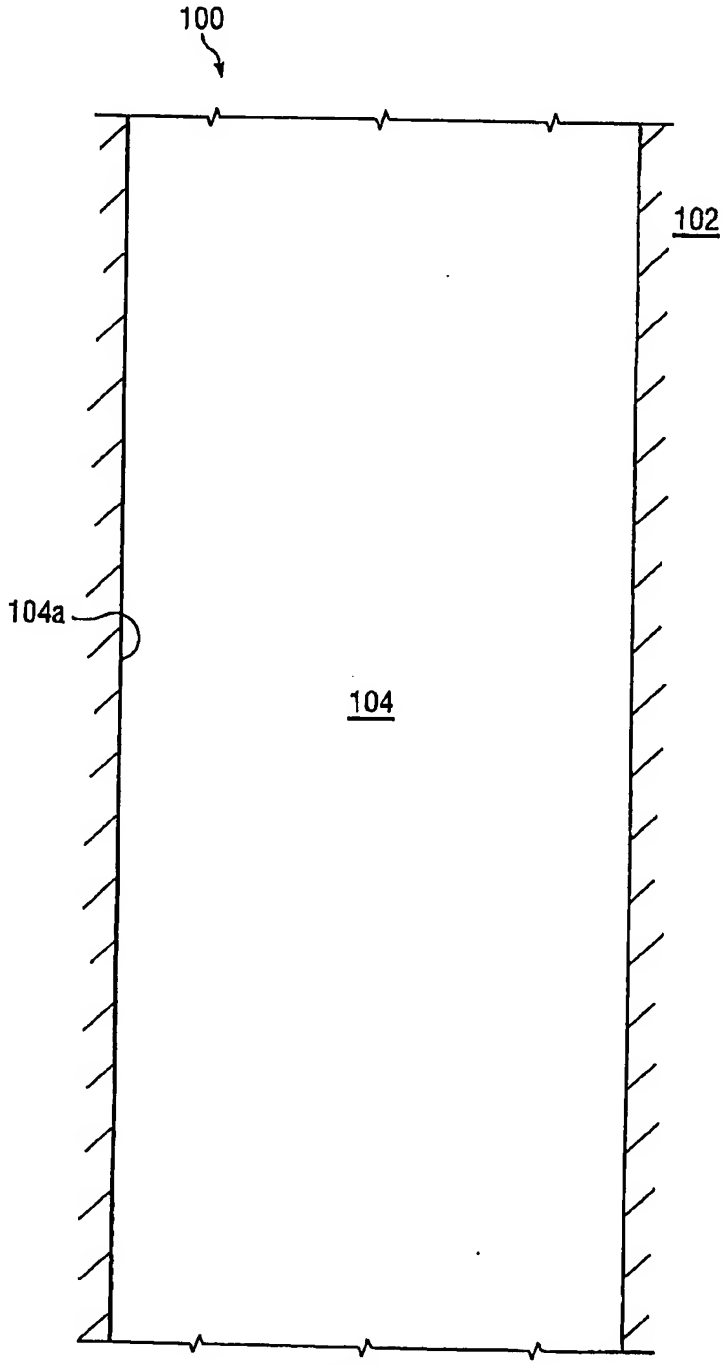

Fig. 1

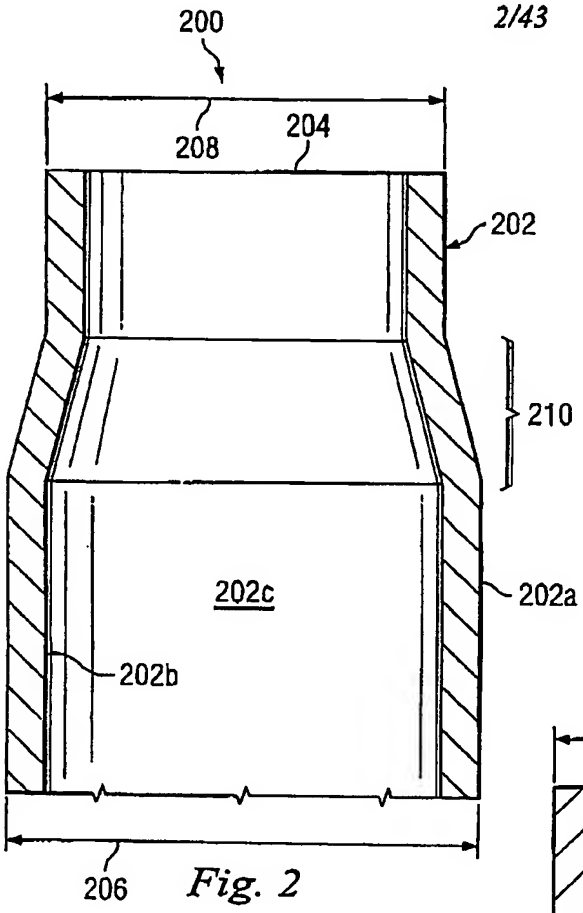
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Fig. 2

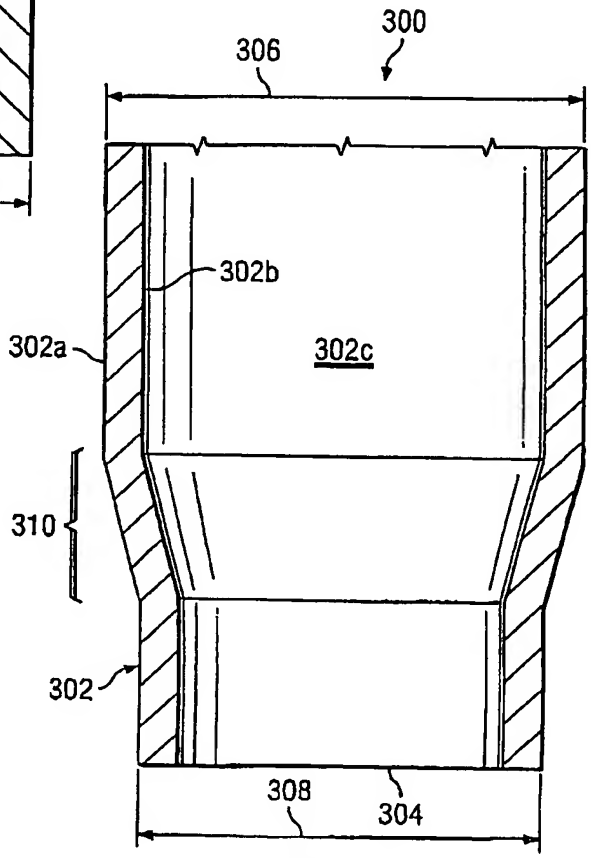
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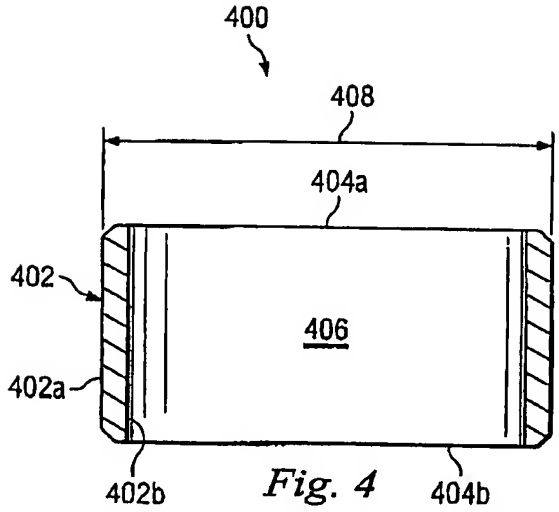
Fig. 3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402b
404b

Fig. 4

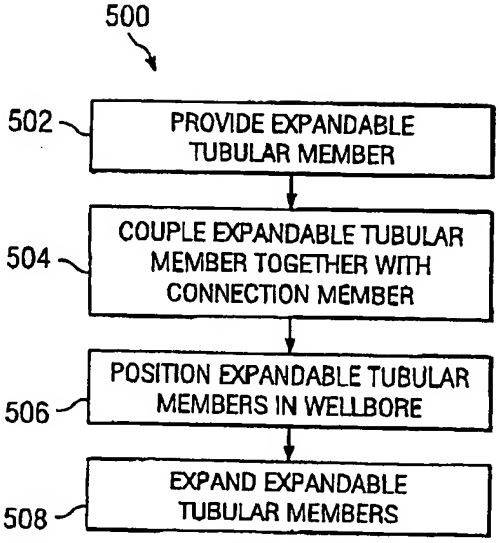
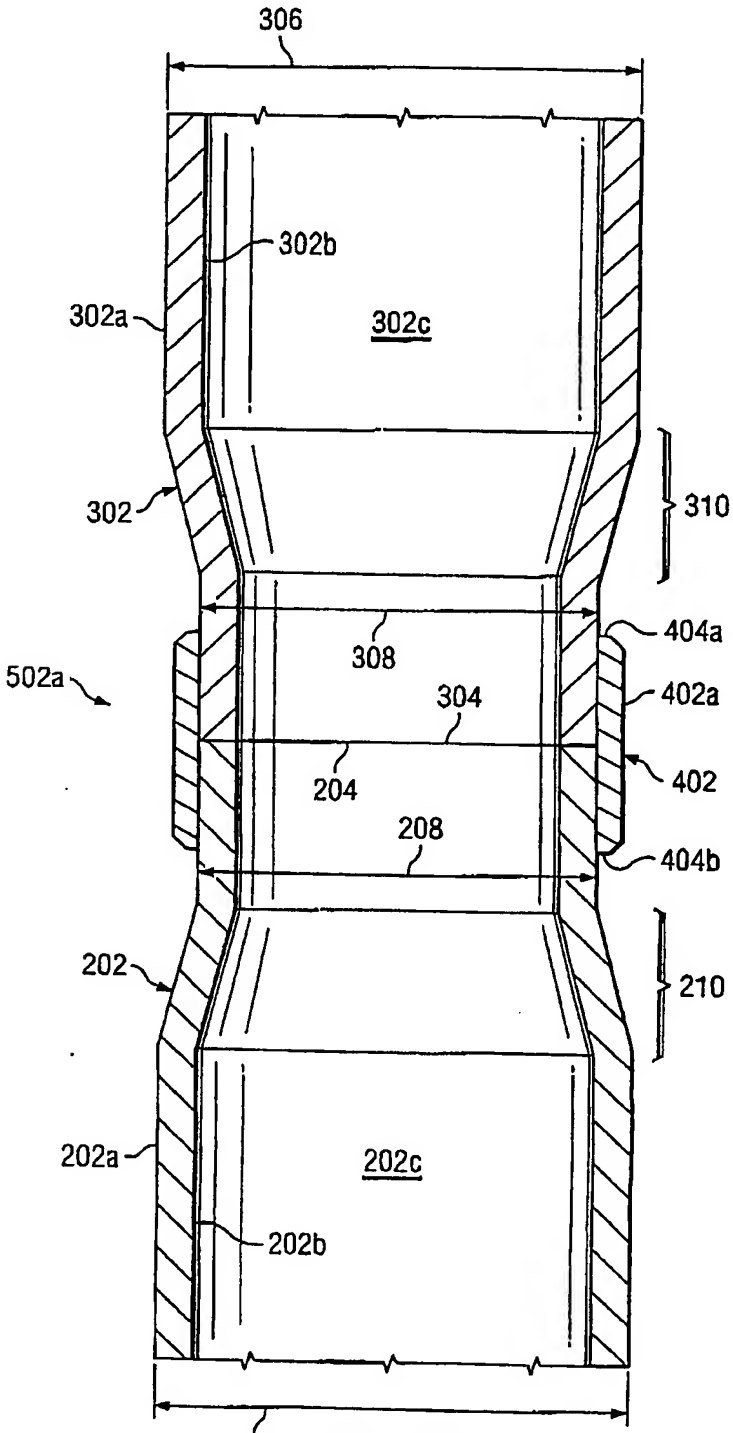

500
502
PROVIDE EXPANDABLE TUBULAR MEMBER
504
COUPLE EXPANDABLE TUBULAR MEMBER TOGETHER WITH CONNECTION MEMBER
506
POSITION EXPANDABLE TUBULAR MEMBERS IN WELLBORE
508
EXPAND EXPANDABLE TUBULAR MEMBERS

Fig. 5a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202a
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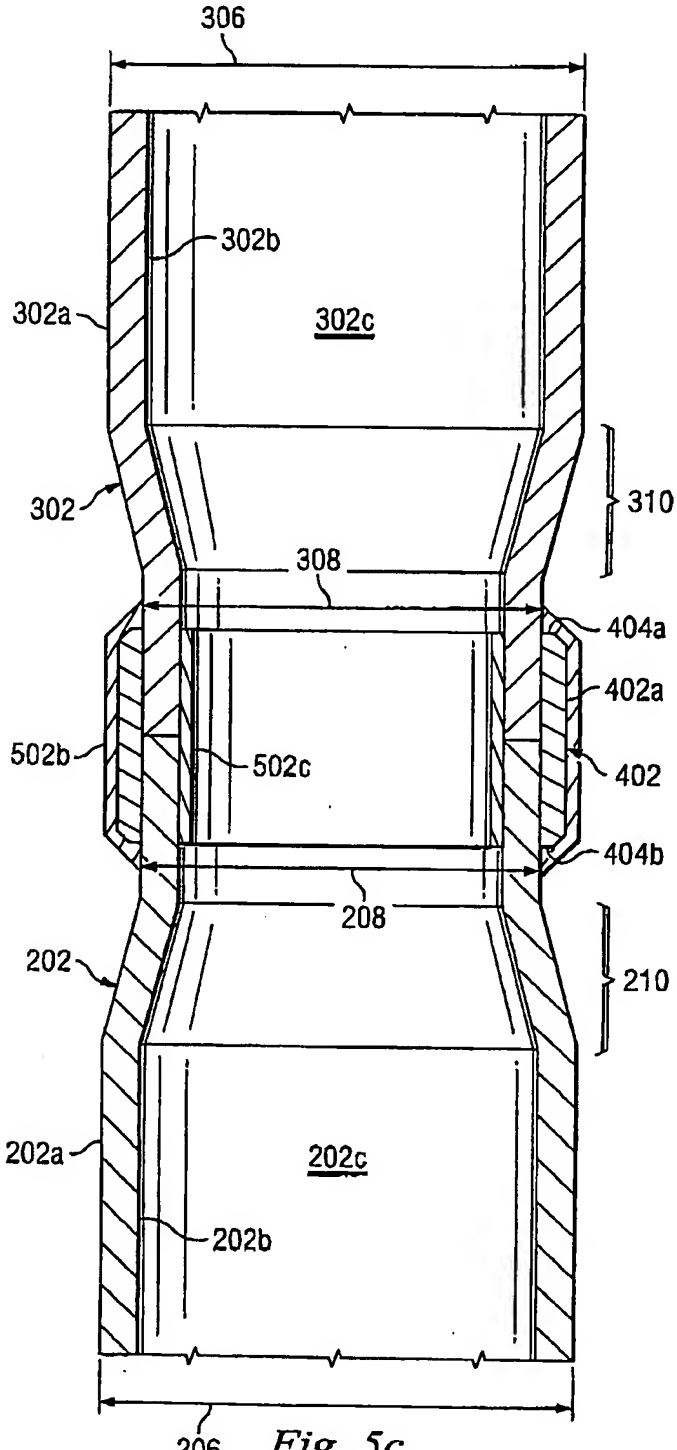
202b
206

Fig. 5b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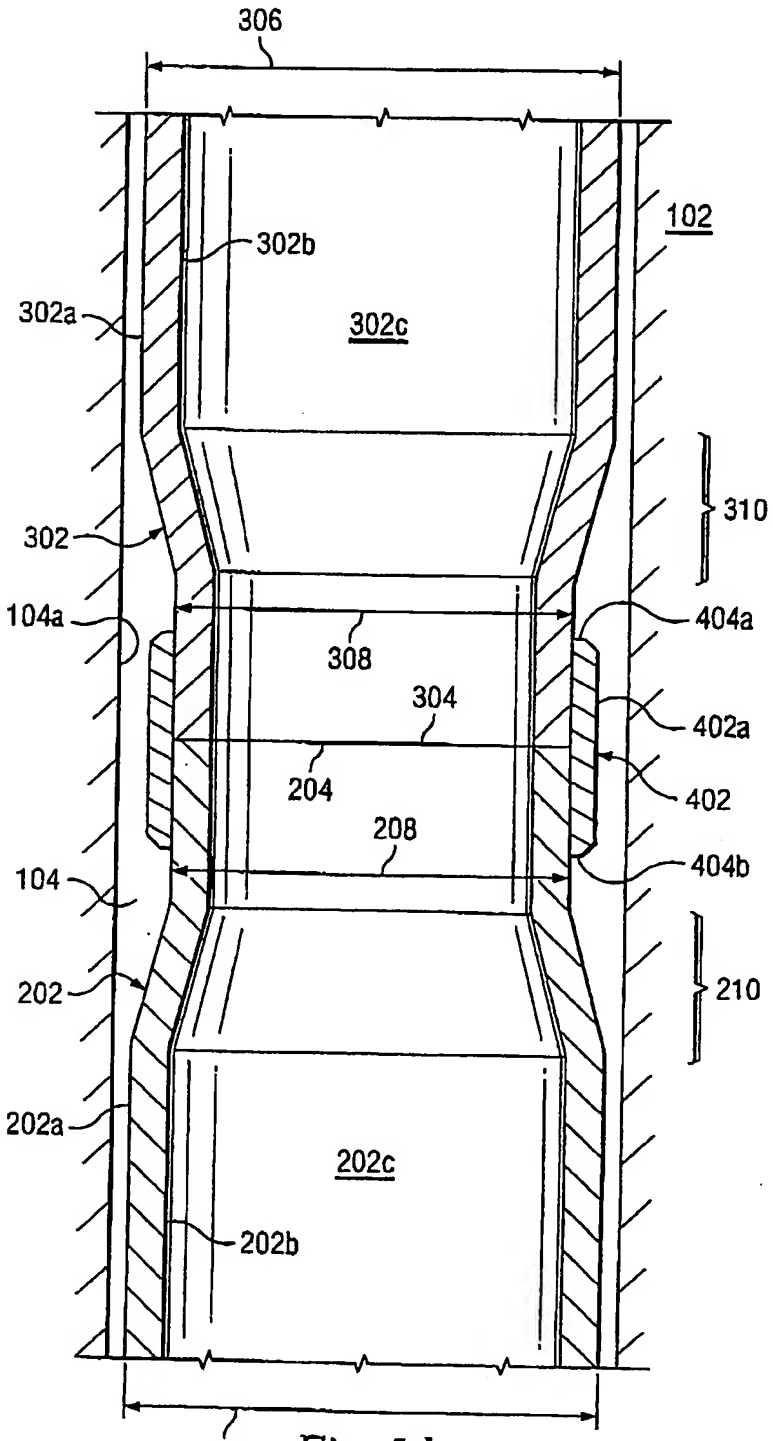
202a
202c
202b
206

Fig. 5c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202c
202b
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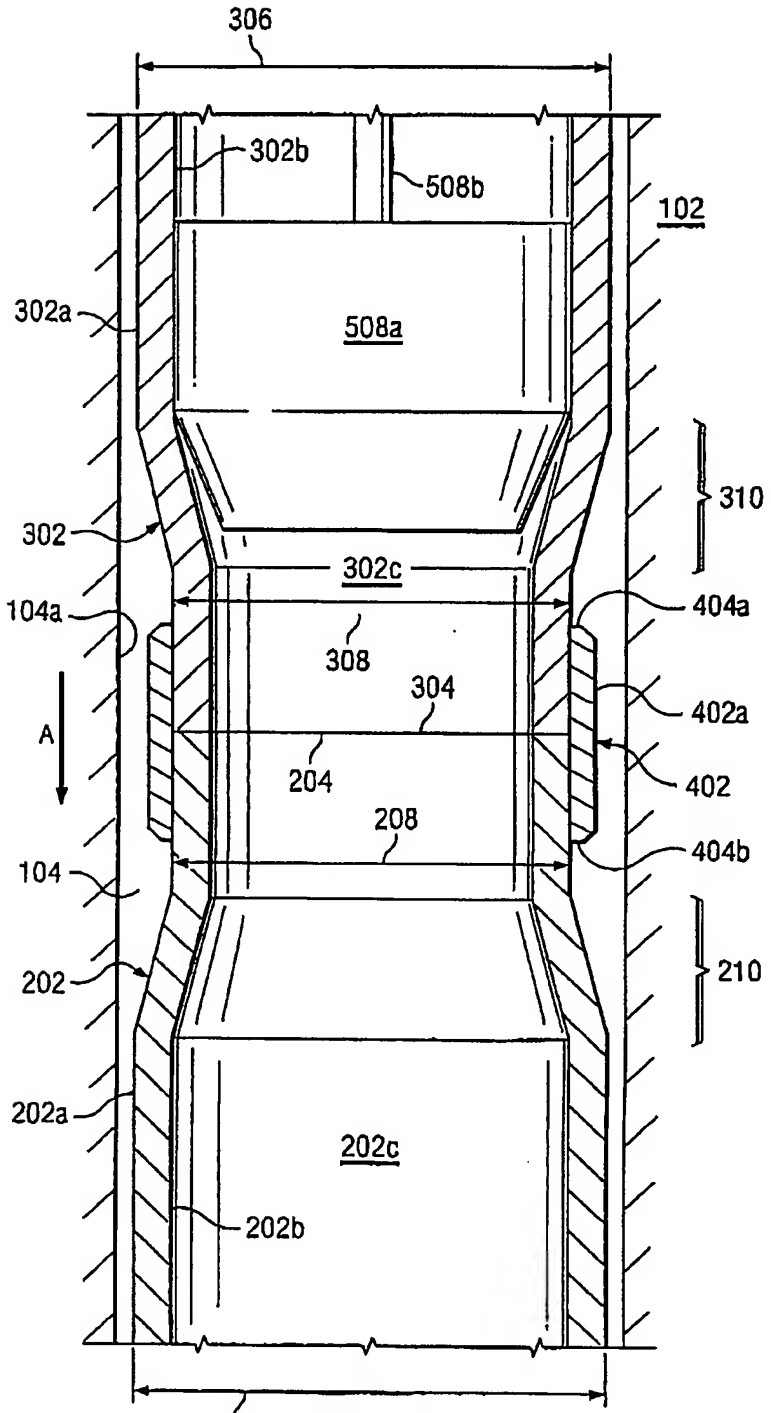
Fig. 5d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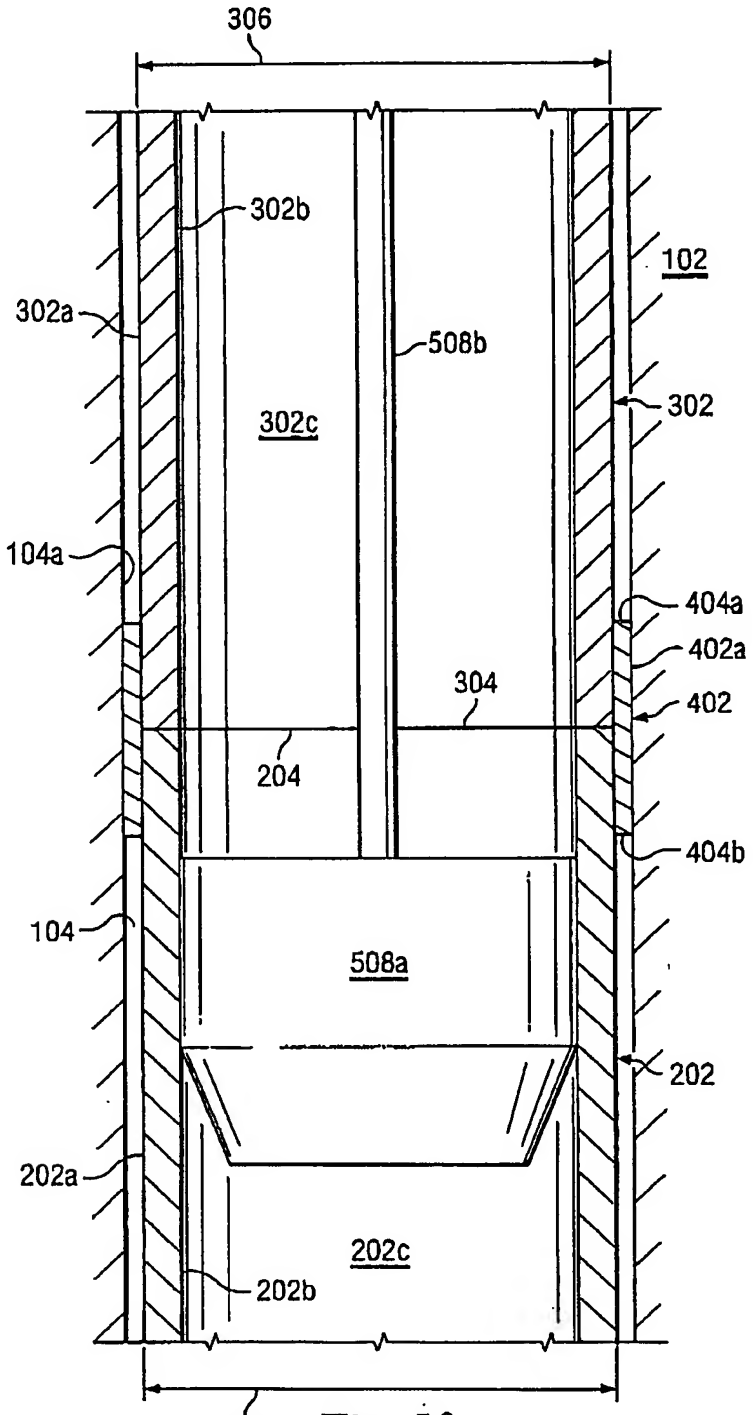
210
202a
202c
202b
206

Fig. 5e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202a
202c
202b
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Fig. 5f

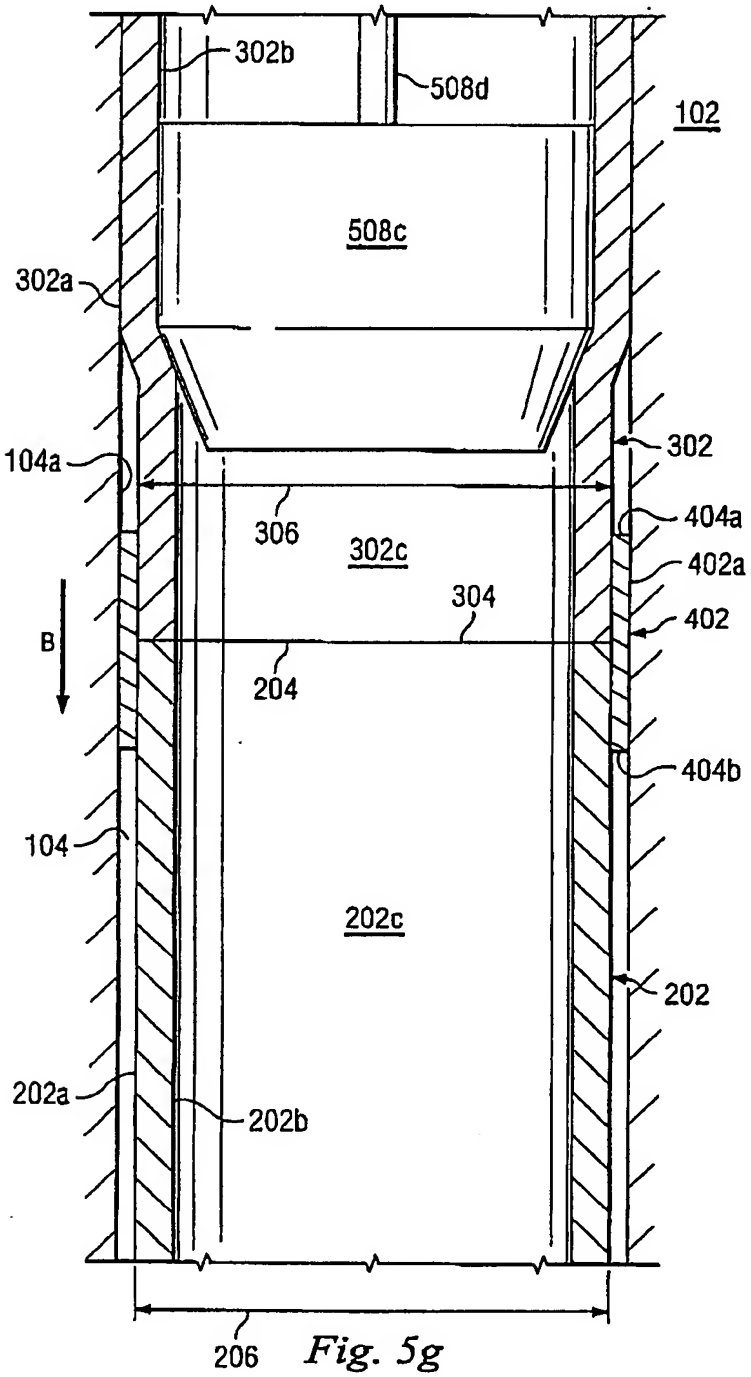
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Fig. 5g

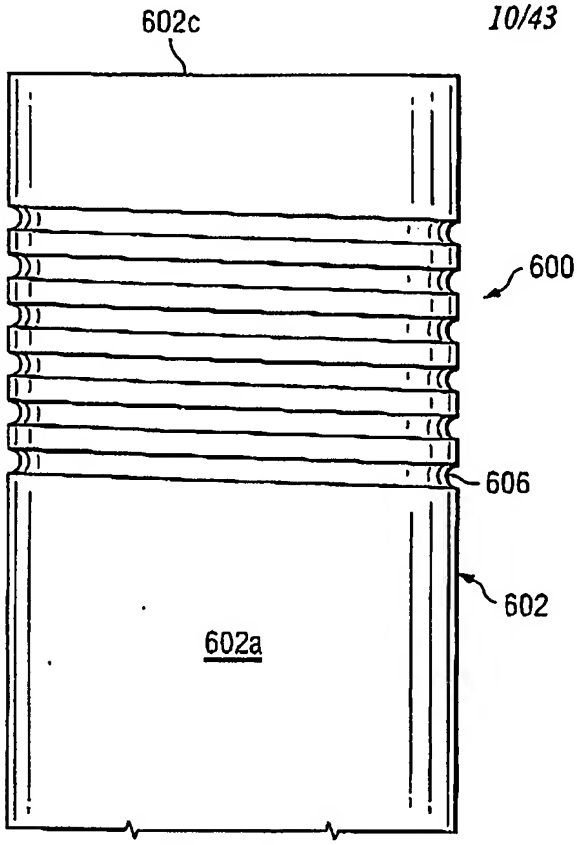


Fig. 6a

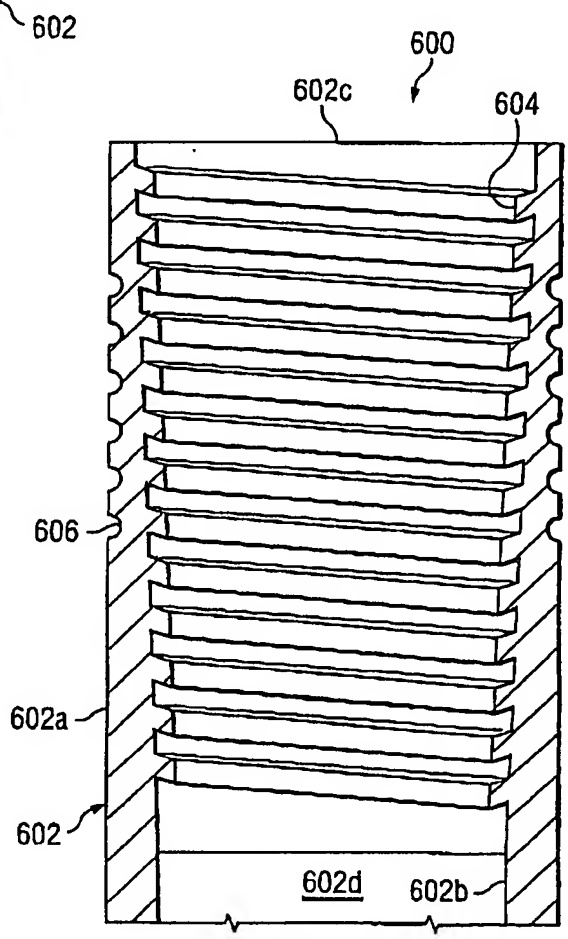
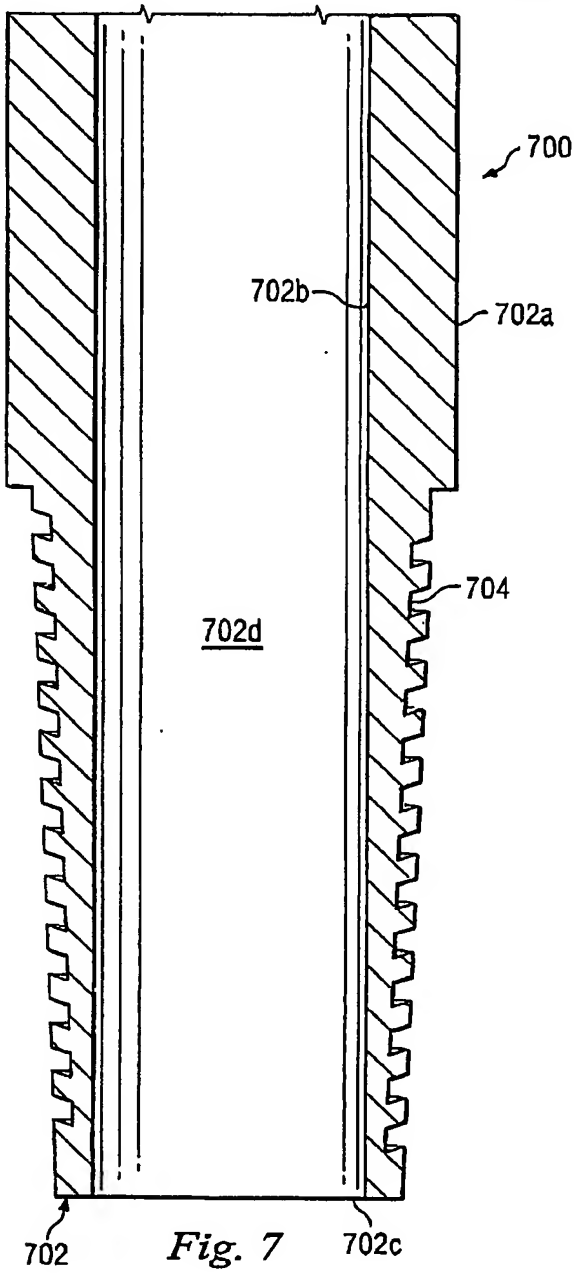


Fig. 6b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702d
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702c

Fig. 7

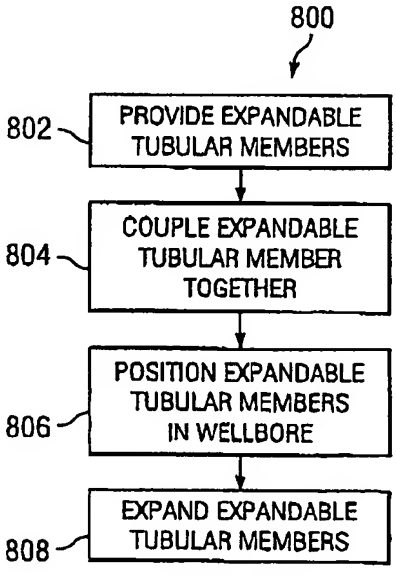
800
802
PROVIDE EXPANDABLE TUBULAR MEMBERS
804
COUPLE EXPANDABLE TUBULAR MEMBER TOGETHER
806
POSITION EXPANDABLE TUBULAR MEMBERS IN WELLBORE
808
EXPAND EXPANDABLE TUBULAR MEMBERS

Fig. 8a

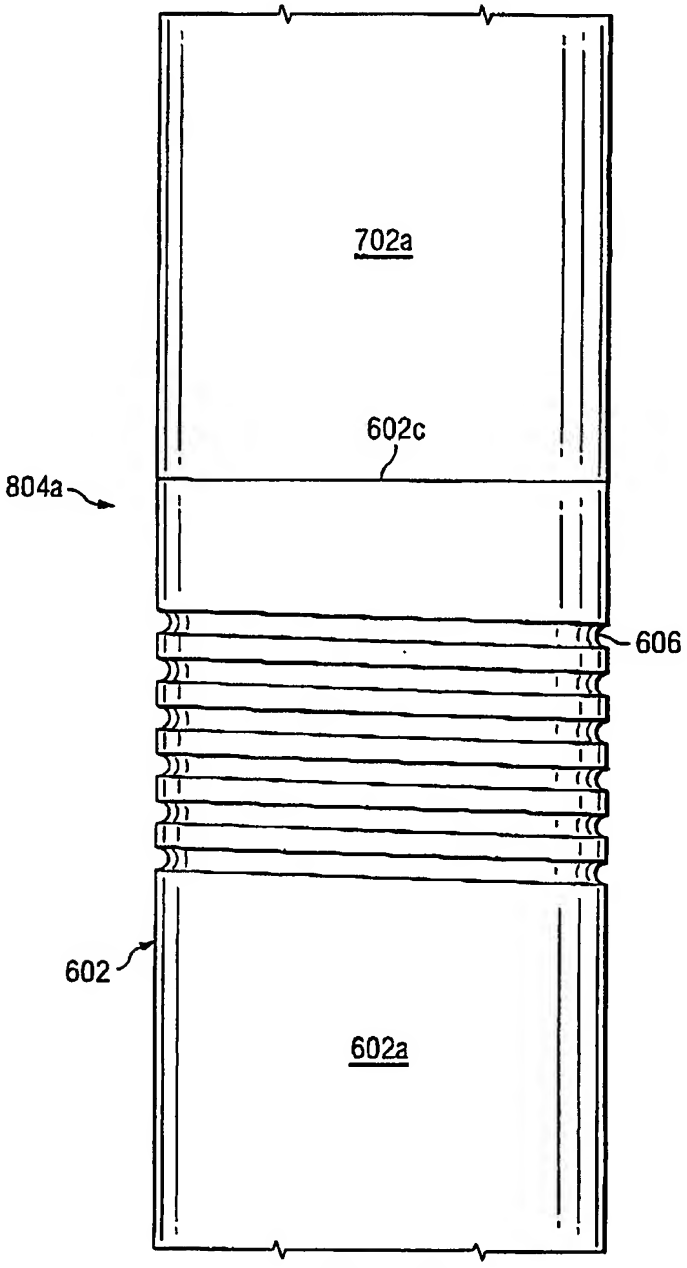

Fig. 8b

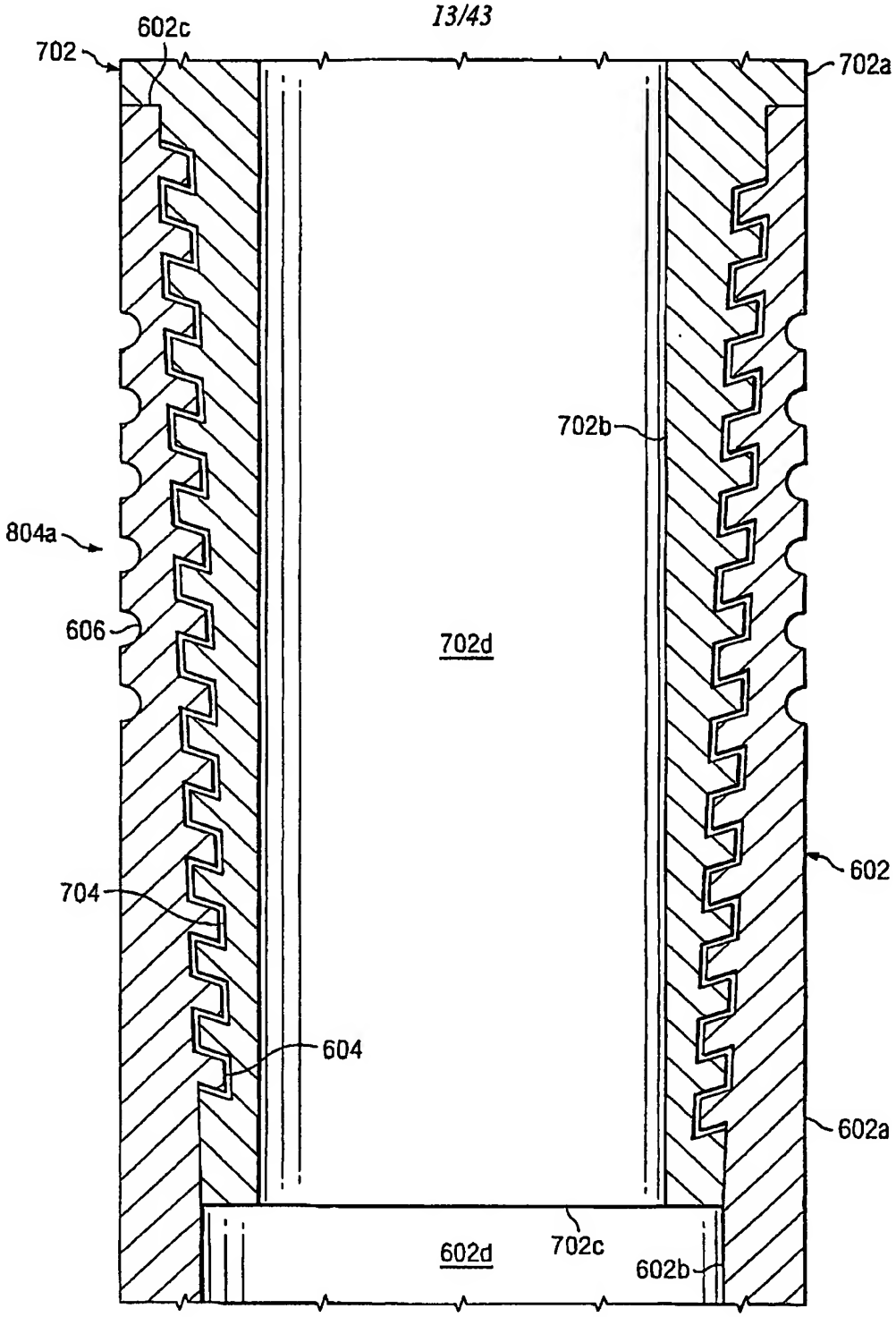
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Fig. 8c

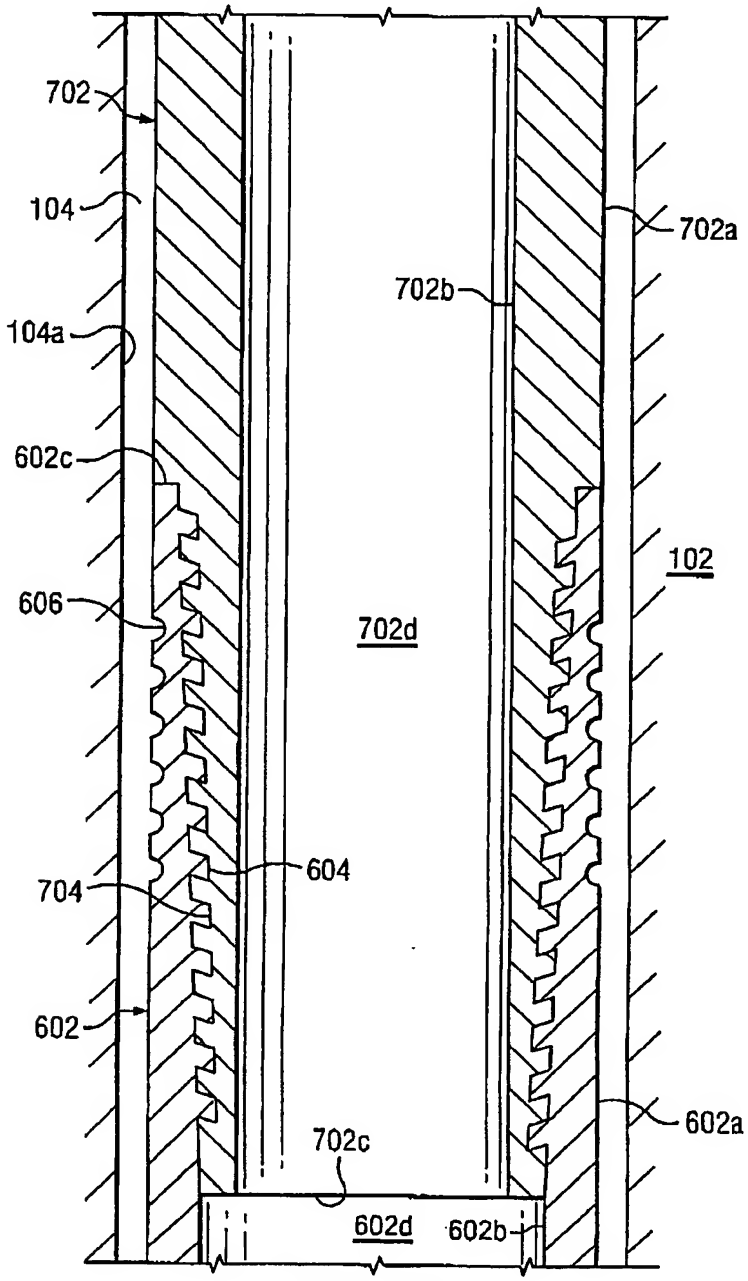
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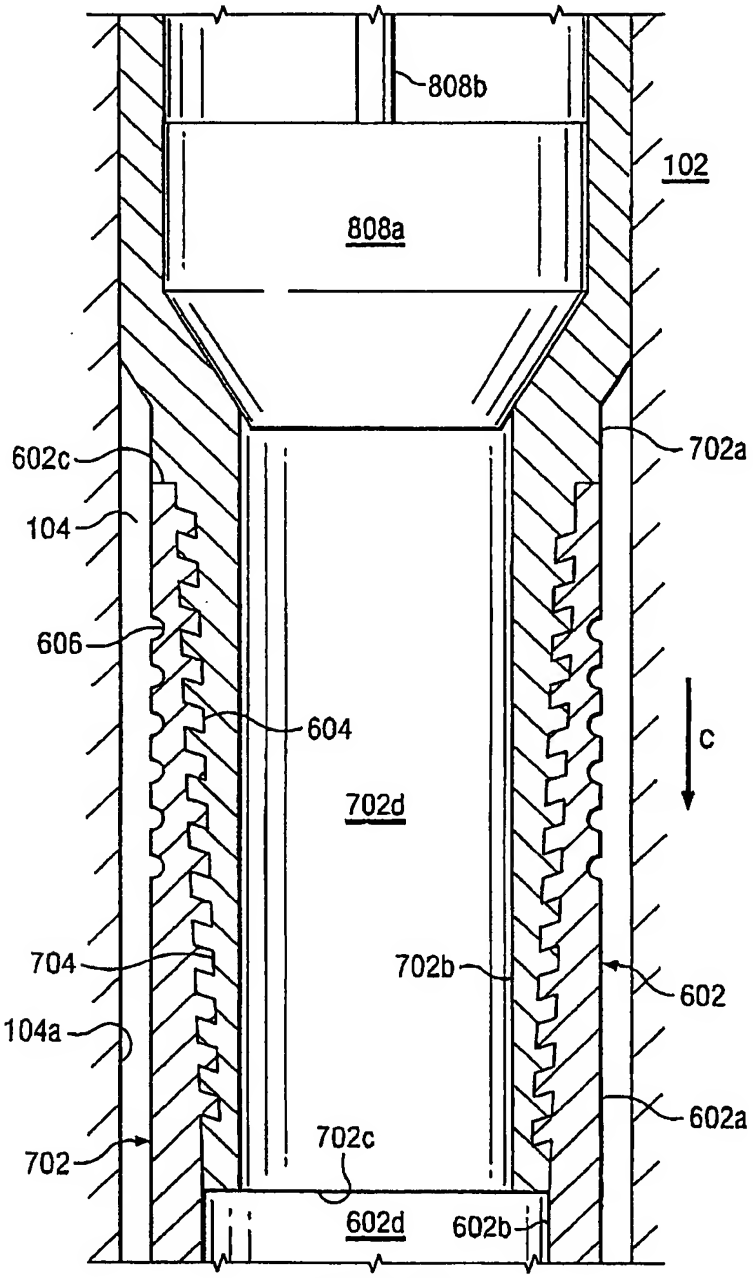
Fig. 8d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602b

Fig. 8e

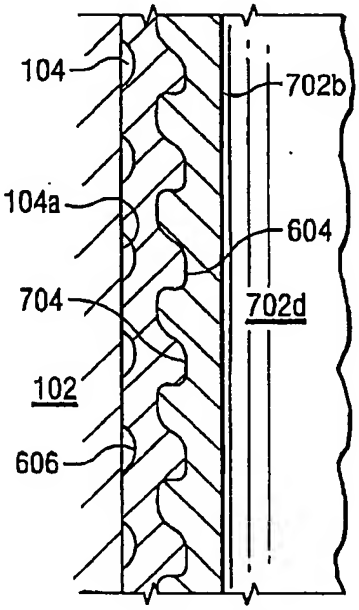


Fig. 8f

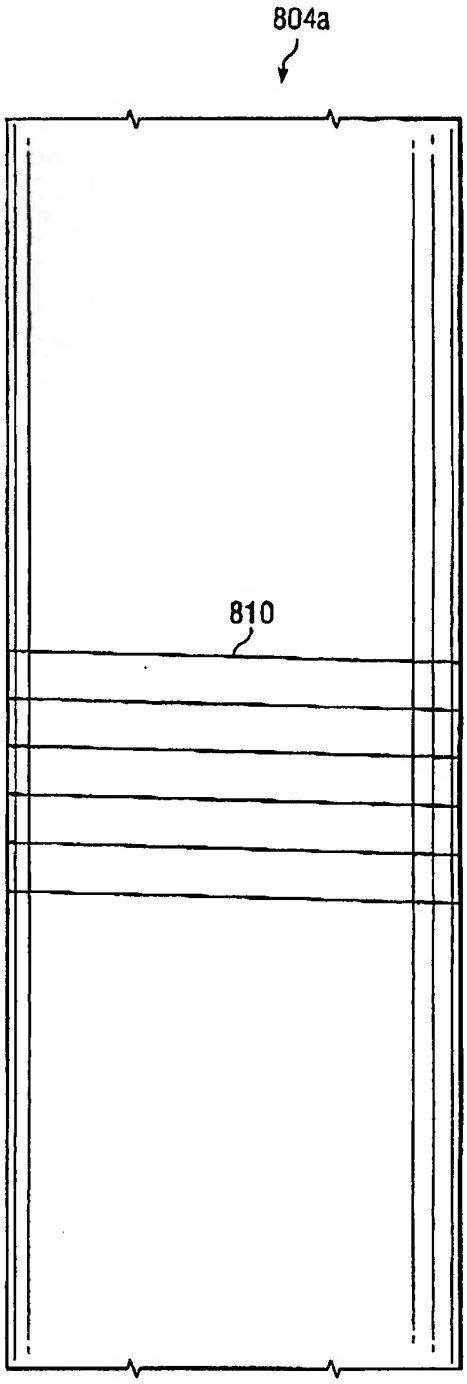
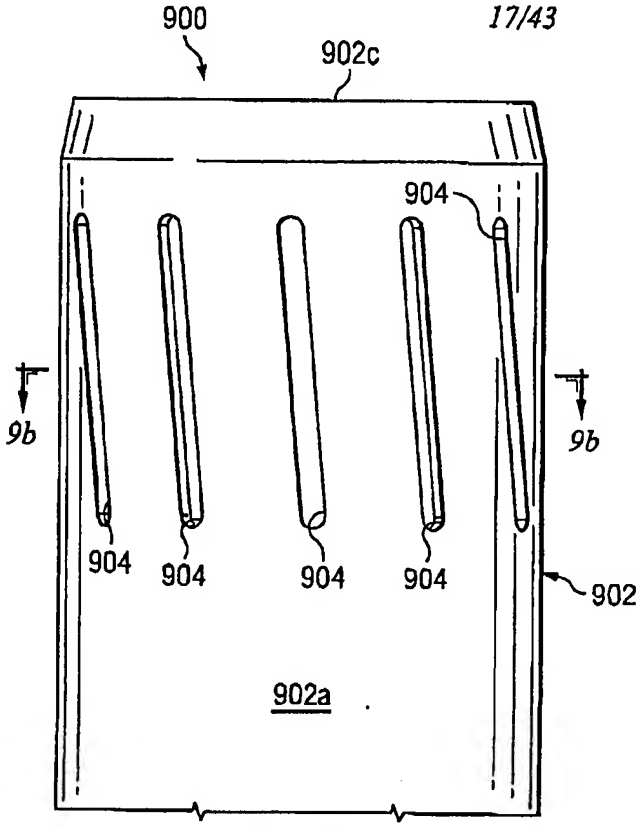


Fig. 8g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902a

Fig. 9a

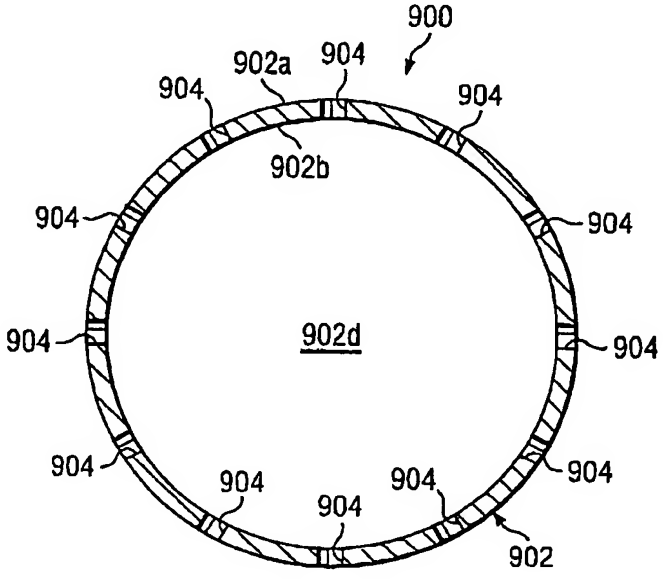
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Fig. 9b

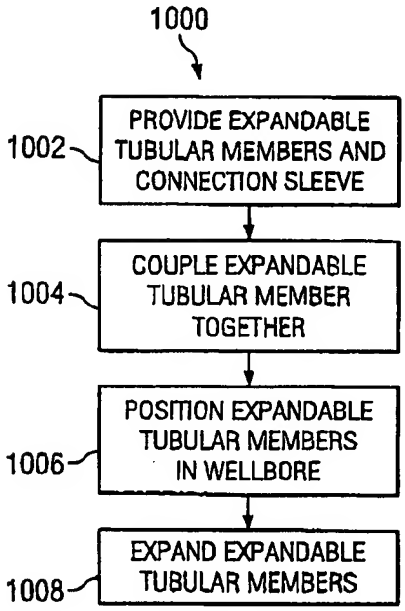


Fig. 10a

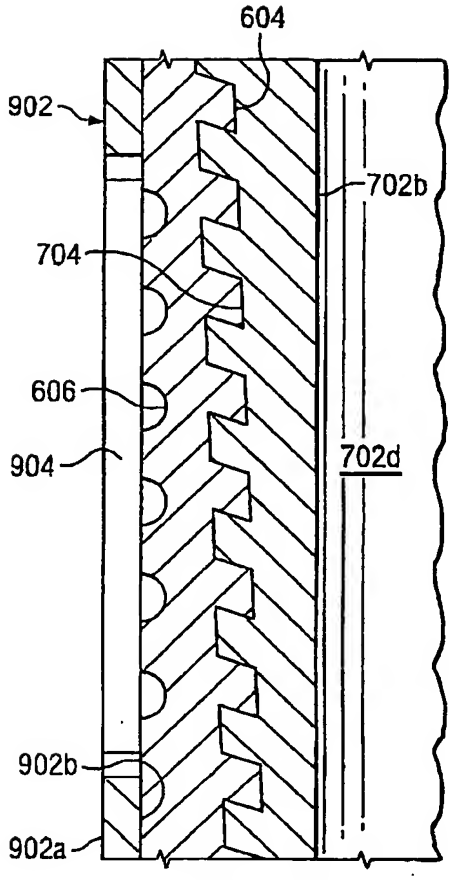


Fig. 10c

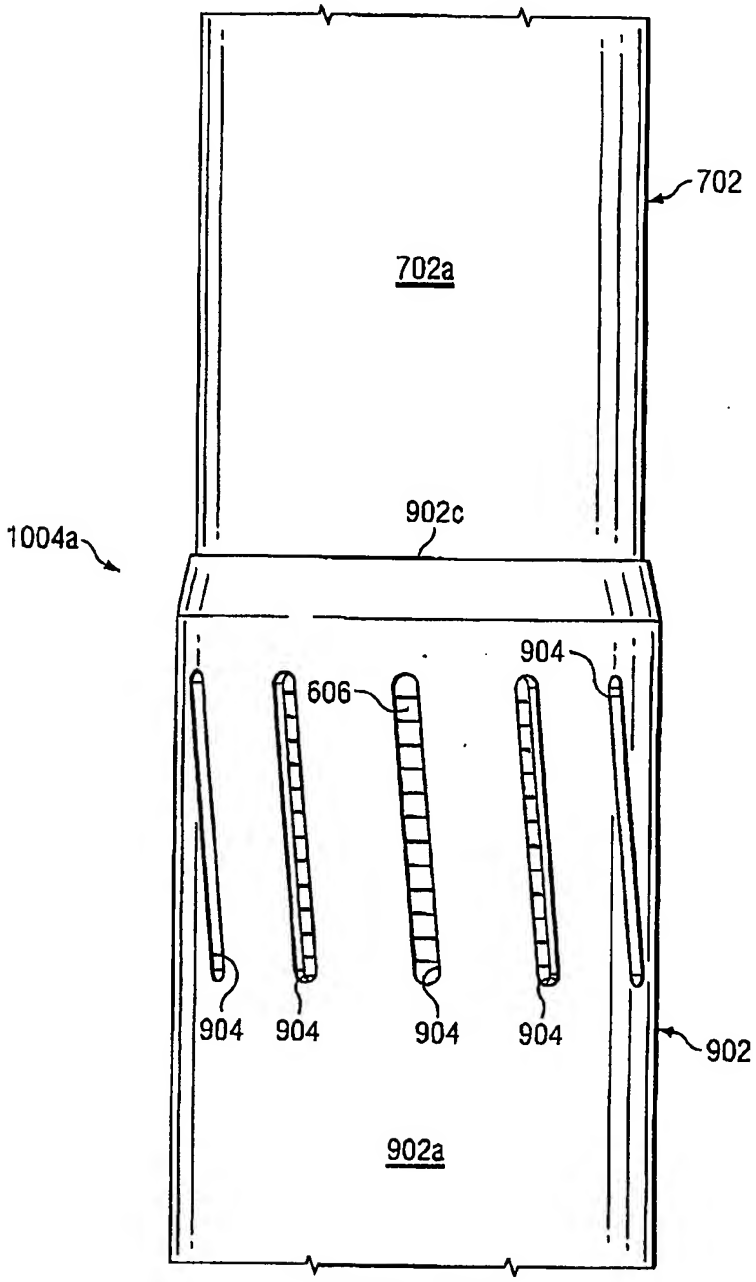


Fig. 10b

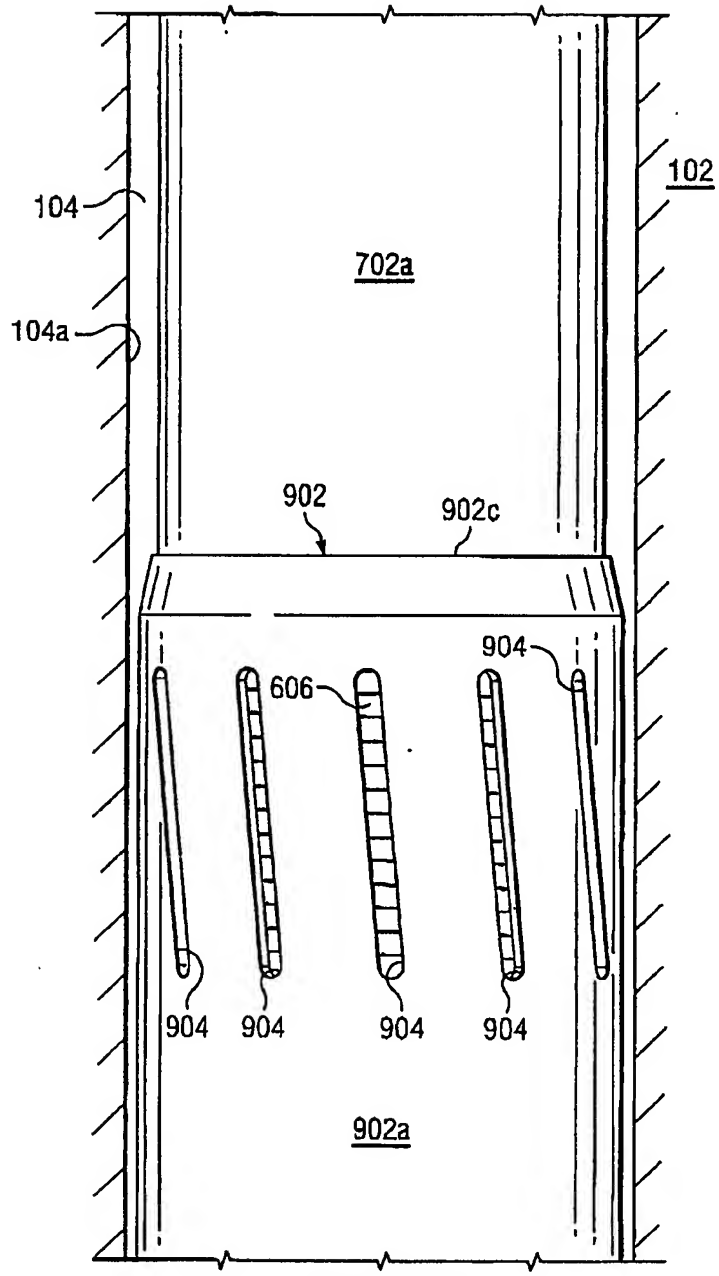
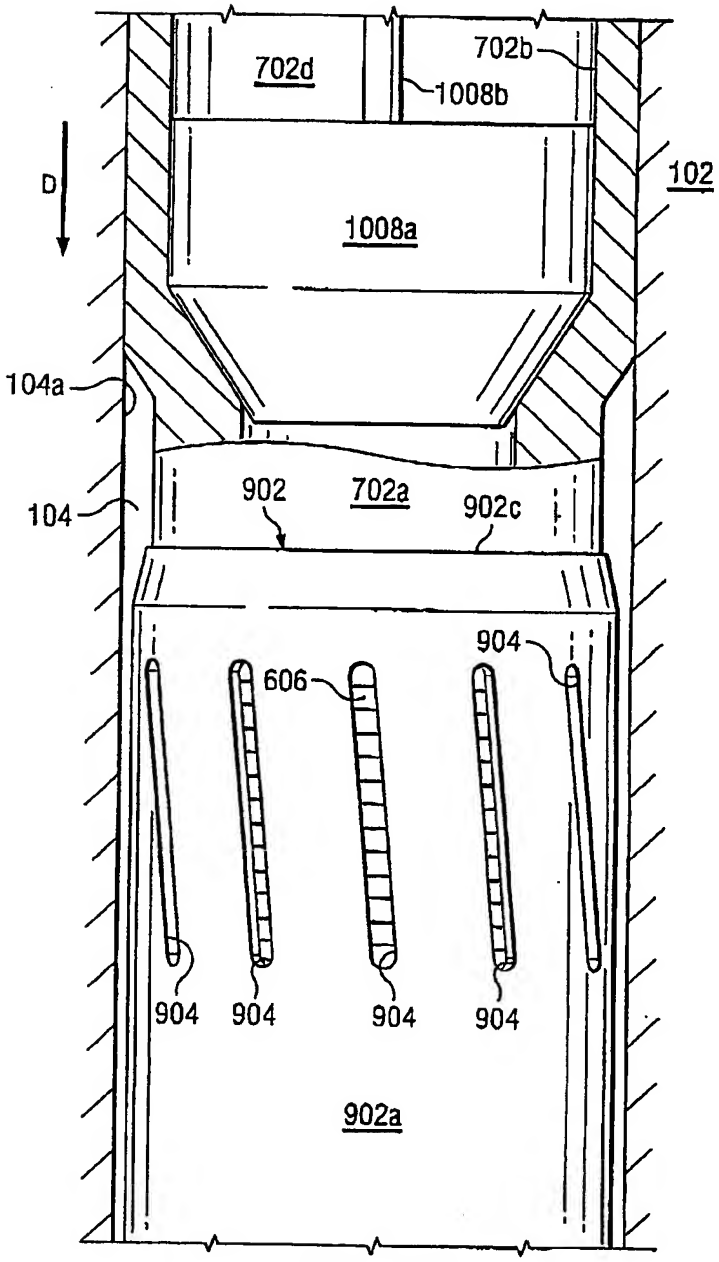


Fig. 10d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902a

Fig. 10e

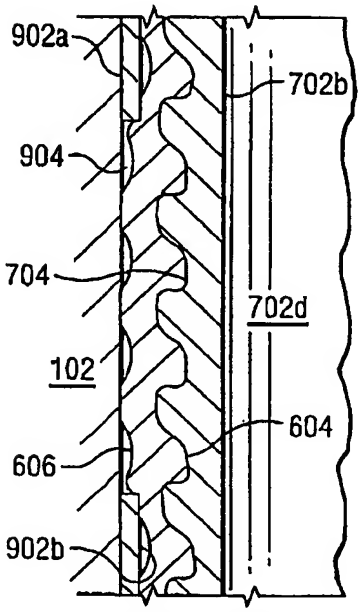

Fig. 10f

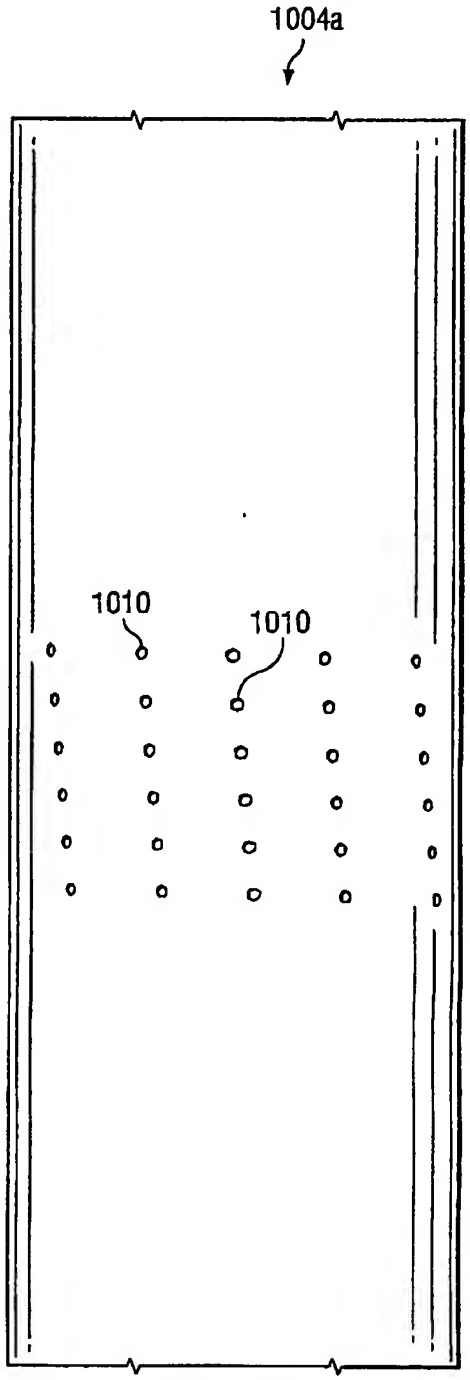

Fig. 10g

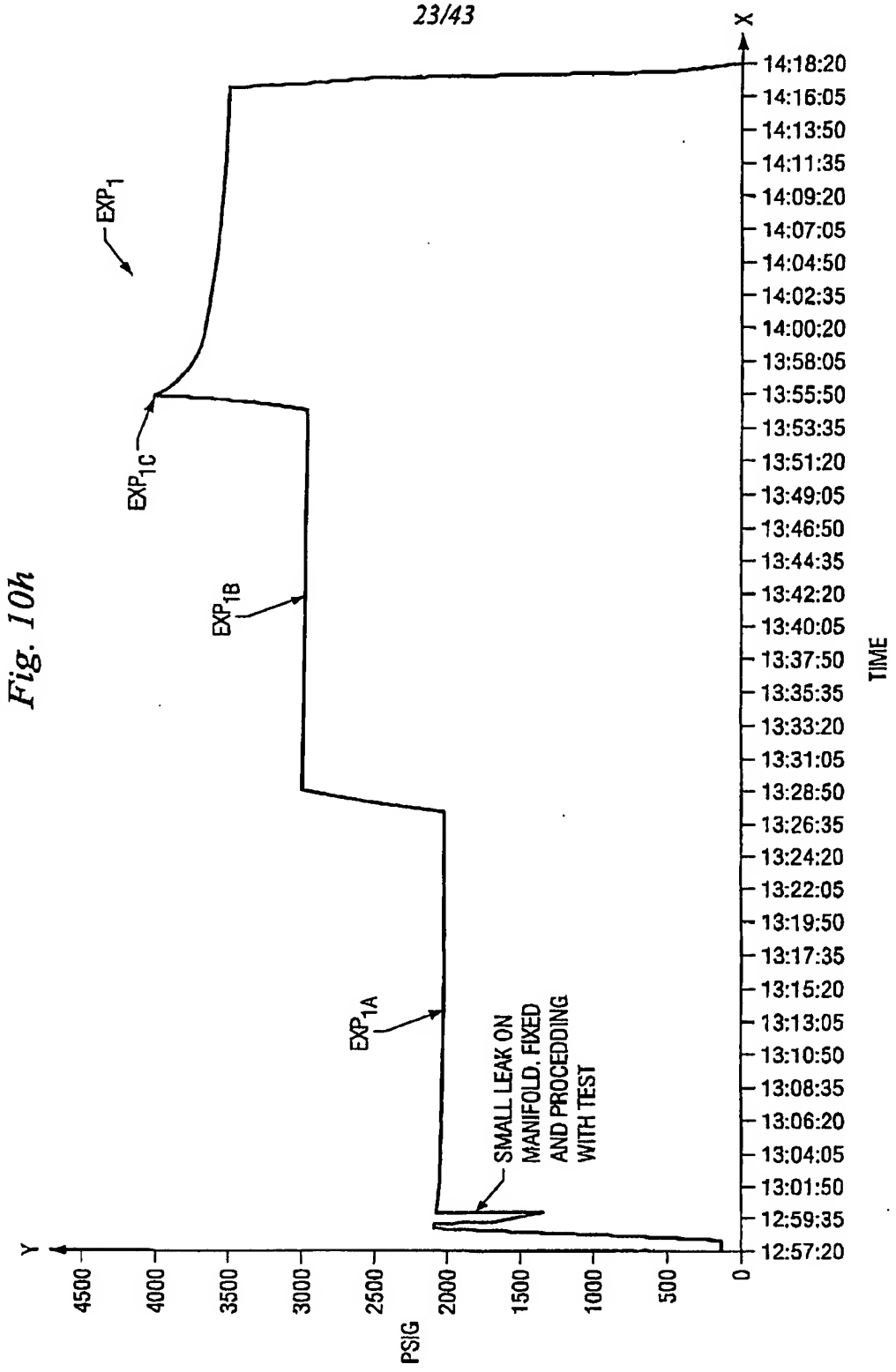
X
14:18:20
14:16:05
14:13:50
14:11:35
14:09:20
14:07:05
14:04:50
14:02:35
14:00:20
13:58:05
13:55:50
13:53:35
13:51:20
13:49:05
13:46:50
13:44:35
13:42:20
13:40:05
13:37:50
13:35:35
13:33:20
13:31:05
13:28:50
13:26:35
13:24:20
13:22:05
13:19:50
13:17:35
13:15:20
13:13:05
13:10:50
13:08:35
13:06:20
13:04:05
13:01:50
12:59:35
12:57:20
TIME
EXP1
EXP1C
EXP1B
EXP1A
SMALL LEAK ON MANIFOLD. FIXED AND PROCEDDING WITH TEST
Y
4500
4000
3500
3000
2500
2000
1500
1000
500
0
PSIG

Fig. 10h

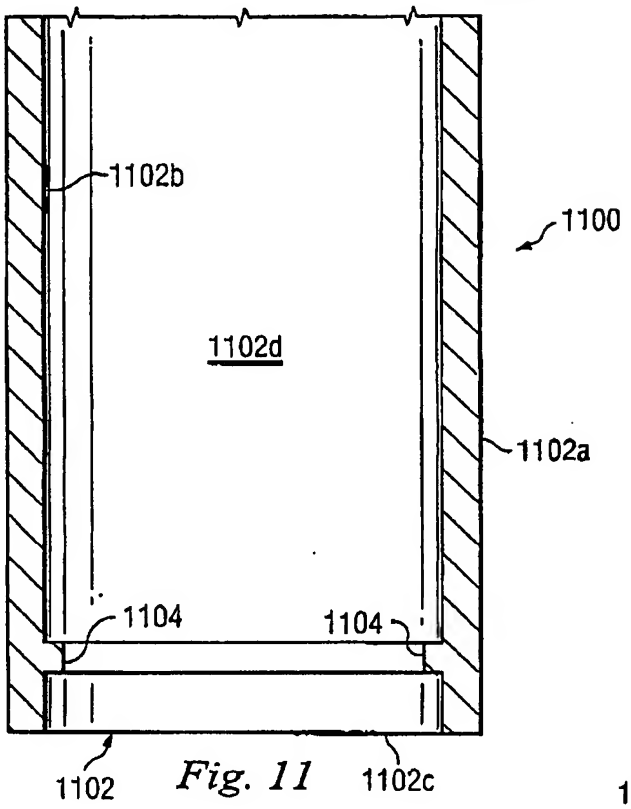
1102b
1100
1102d
1102a
1104
1104
1102
1102c

Fig. 11

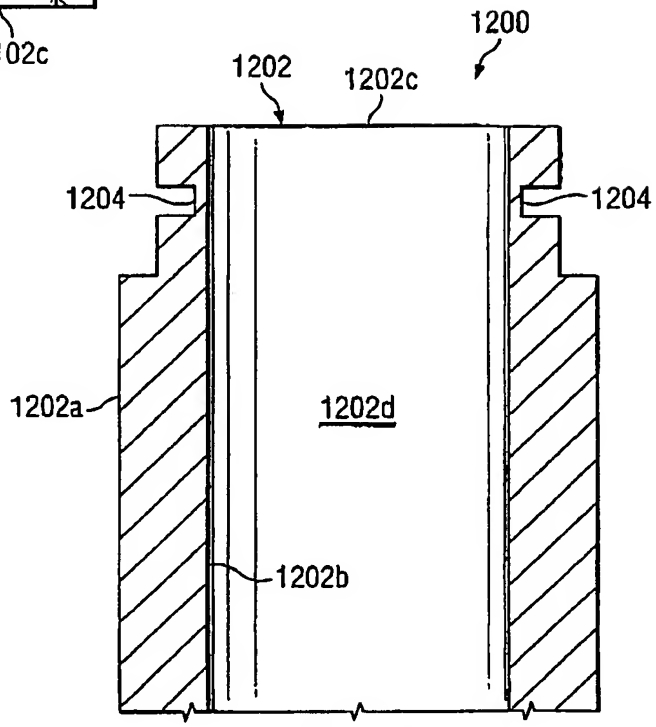
1200
1202
1202c
1204
1204
1202a
1202d
1202b

Fig. 12

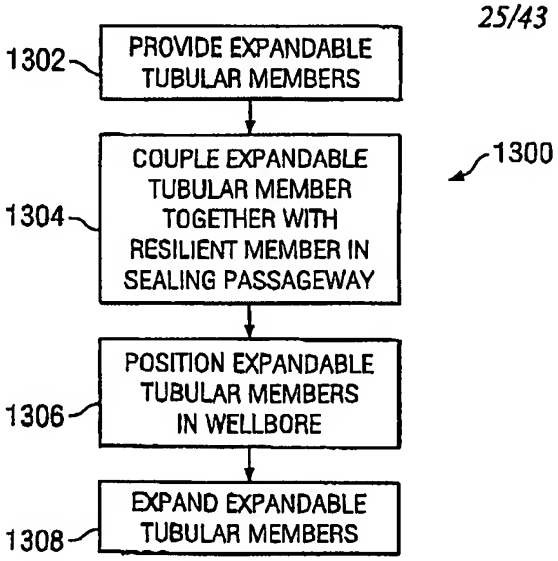

Fig. 13a

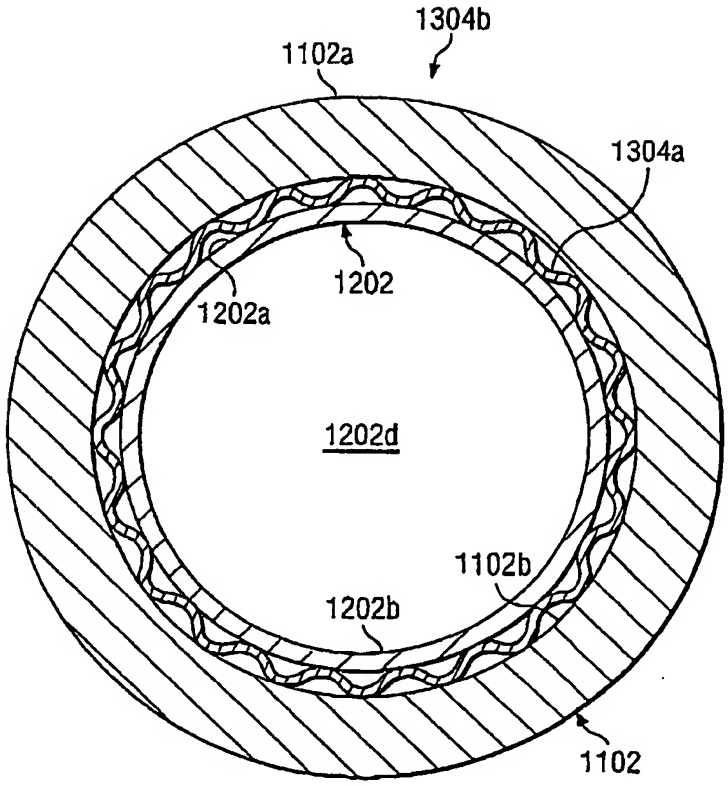

Fig. 13c

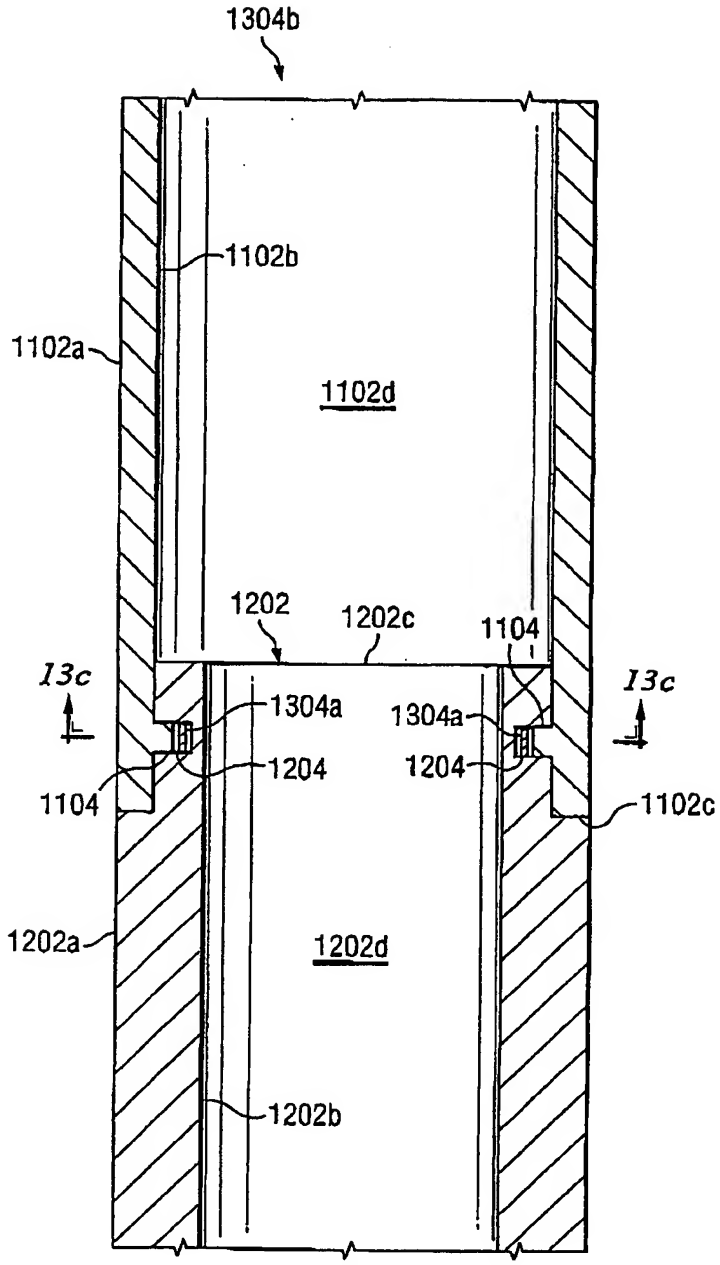
1304b
1102b
1102a
1102d
1202
1202c
1104
13c
13c
1304a
1304a
1204
1204
1104
1102c
1202a
1202d
1202b

Fig. 13b

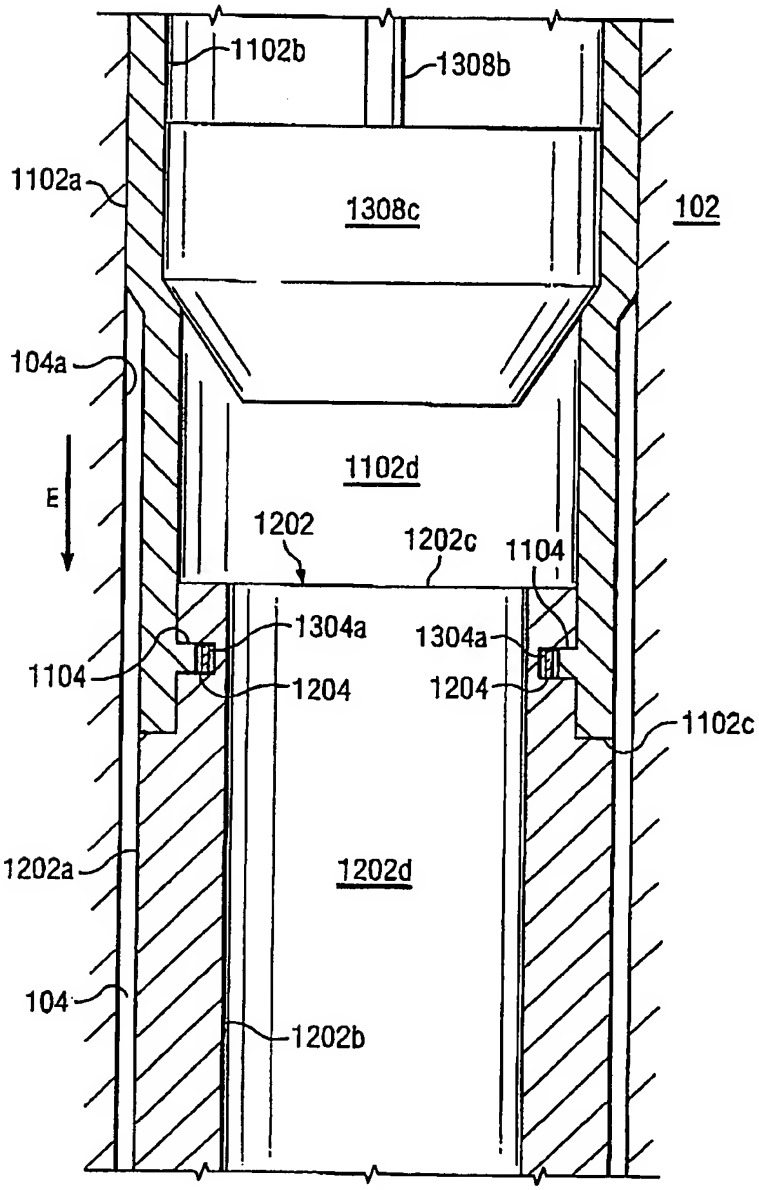
1102b
1308b
1102a
1308c
102
104a
E
1102d
1202
1202c
1104
1304a
1304a
1104
1204
1204
1102c
1202a
1202d
104
1202b

Fig. 13d

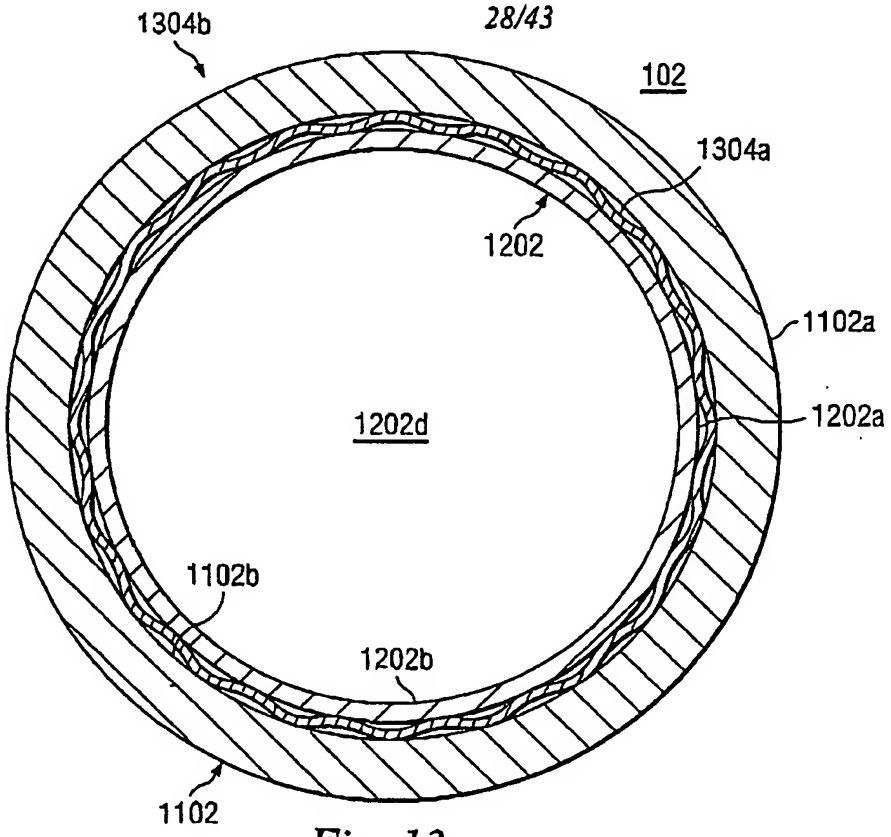

Fig. 13e

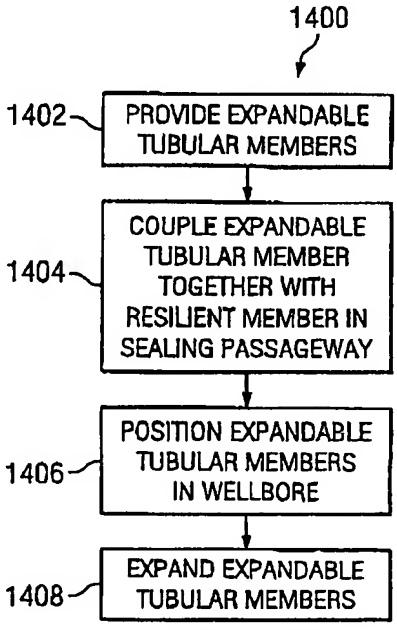

Fig. 14a

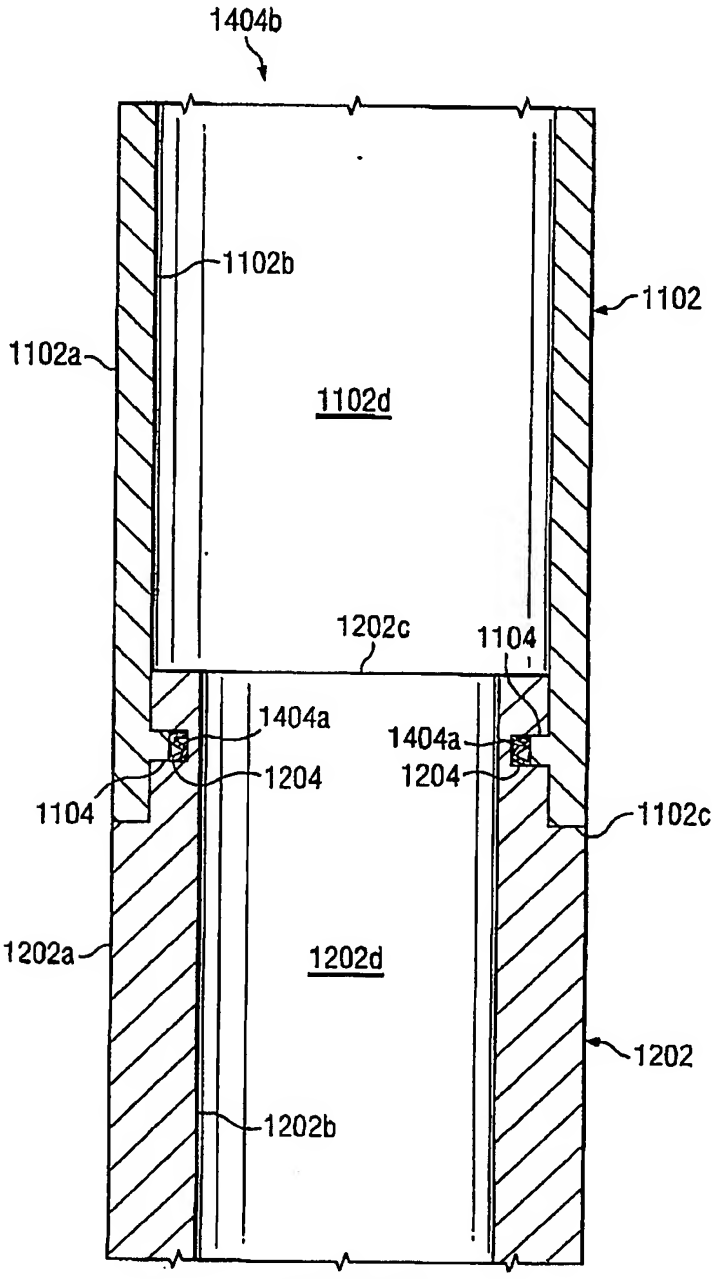
1404b
1102b
1102
1102a
1102d
1202c
1104
1404a
1404a
1204
1204
1104
1102c
1202a
1202d
1202
1202b

Fig. 14b

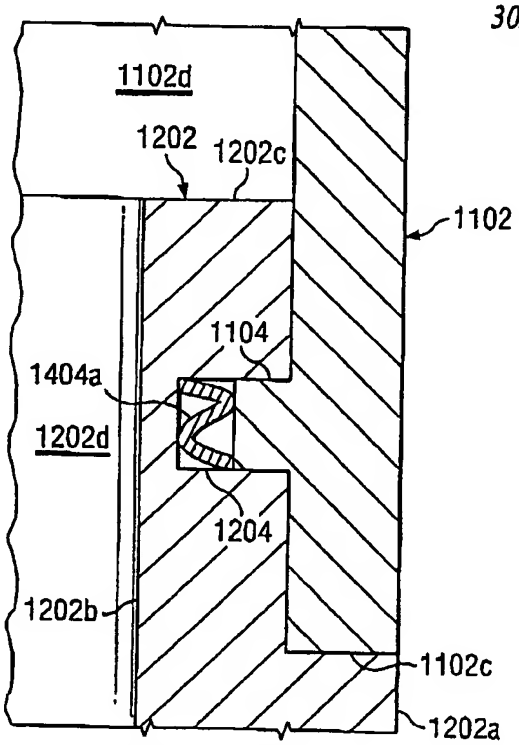

Fig. 14c

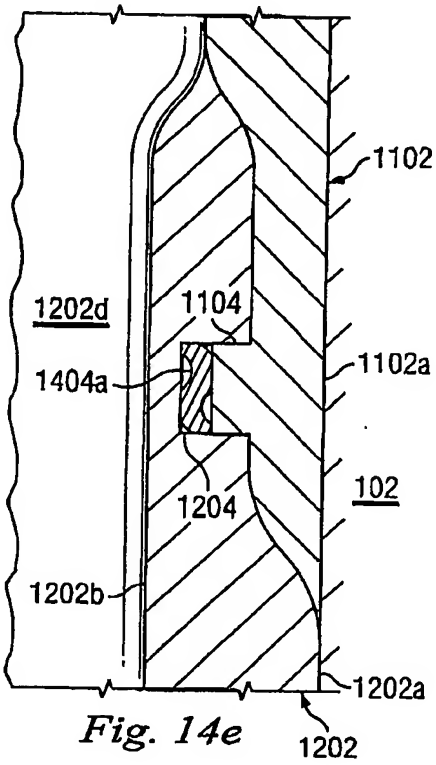

Fig. 14e

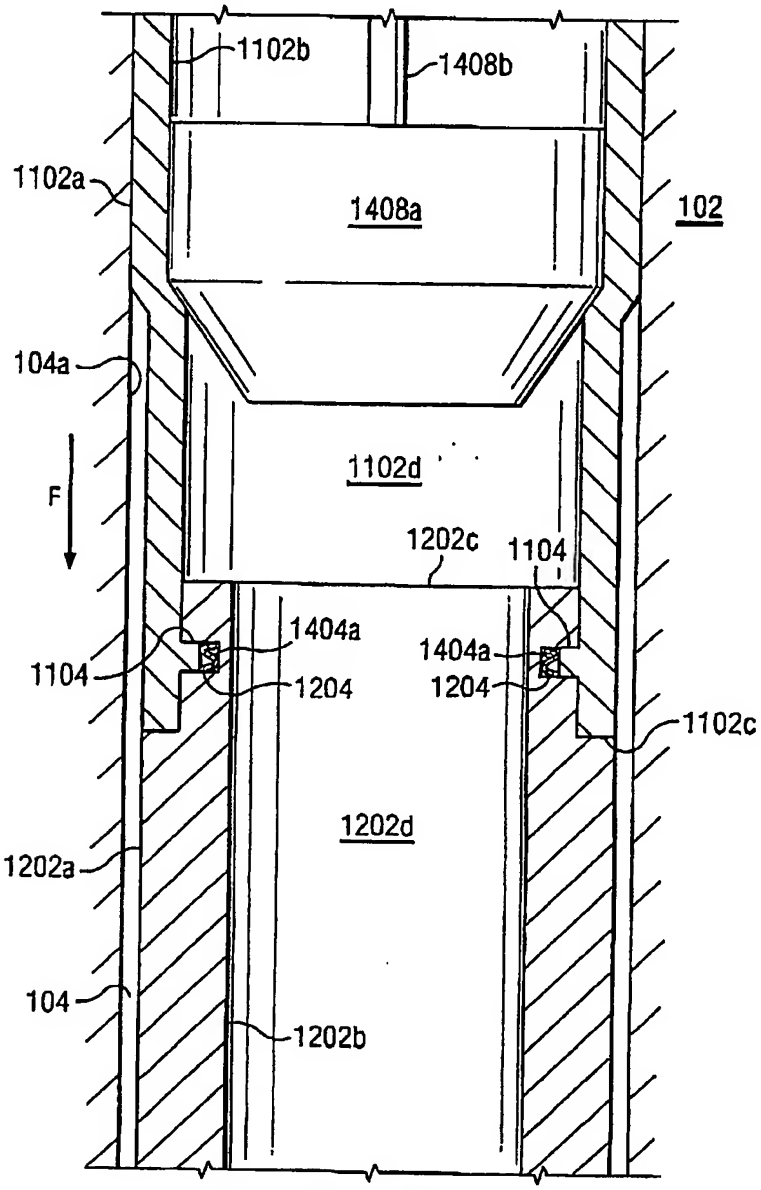
1102b
1408b
1102a
1408a
102
104a
F
1102d
1202c
1104
1404a
1404a
1104
1204
1204
1102c
1202d
1202a
104
1202b

Fig. 14d

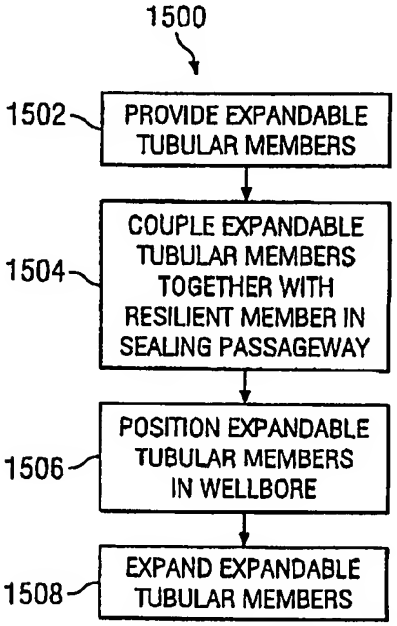

Fig. 15a

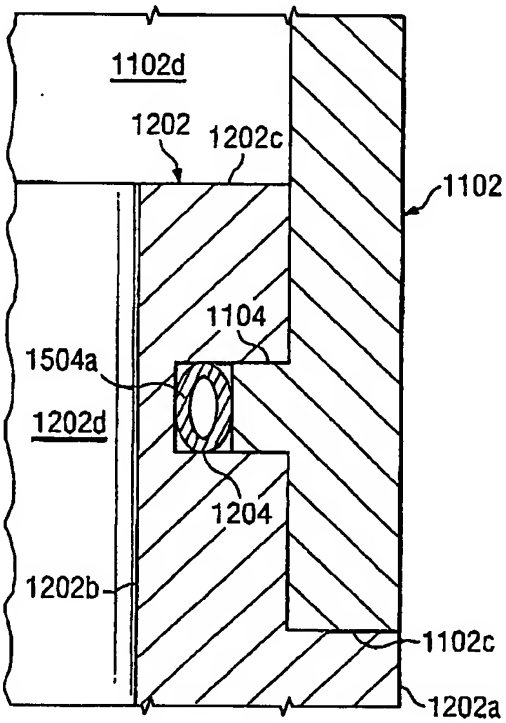

Fig. 15c

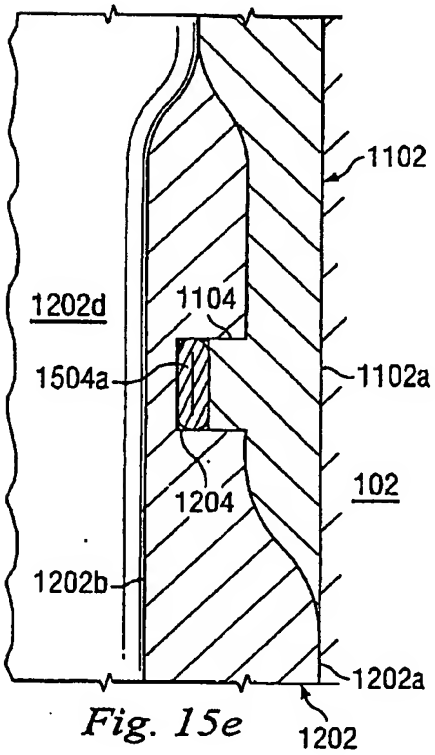

Fig. 15e

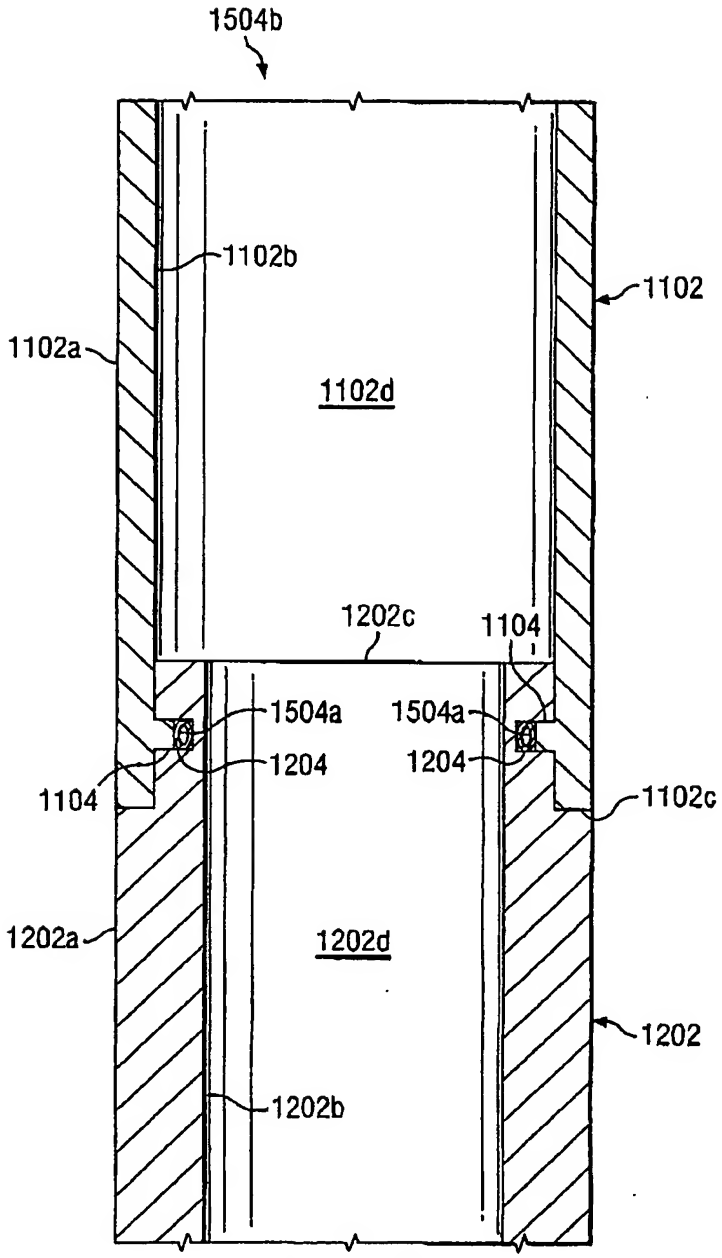
1504b
1102b
1102
1102a
1102d
1202c
1104
1504a
1504a
1204
1204
1104
1102c
1202a
1202d
1202
1202b

Fig. 15b

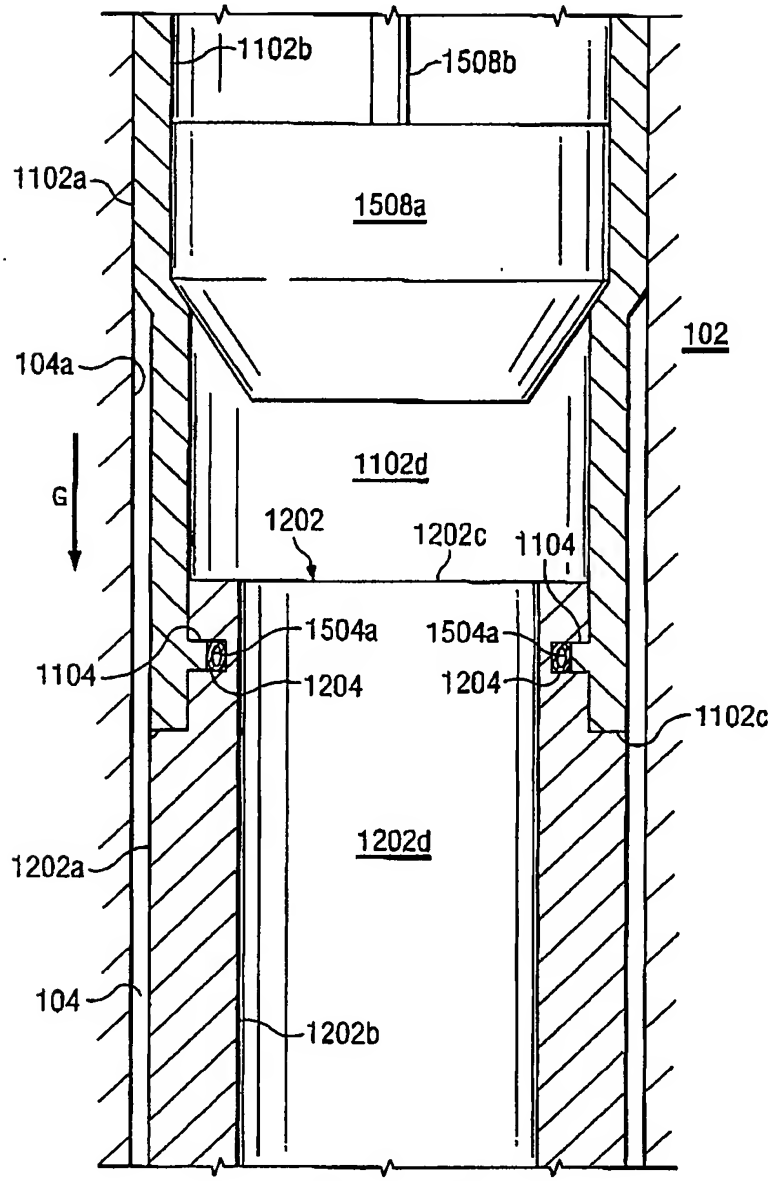
1102b
1508b
1102a
1508a
102
104a
G
1102d
1202
1202c
1104
1504a
1504a
1104
1204
1204
1102c
1202d
1202a
104
1202b

Fig. 15d

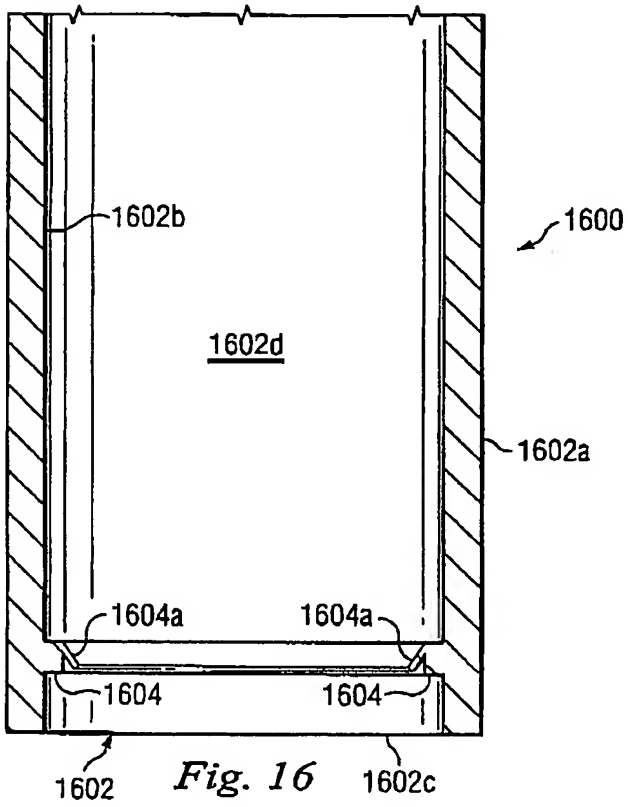

Fig. 16

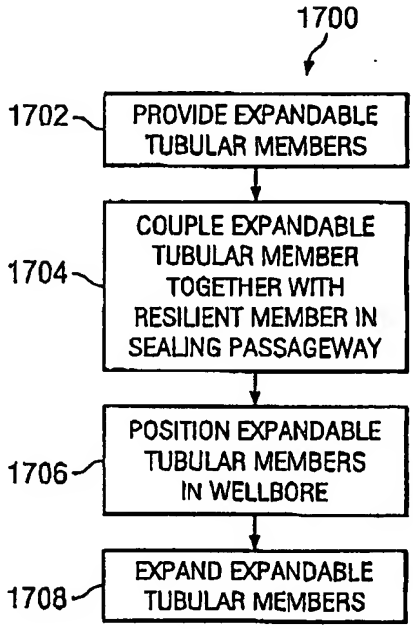

Fig. 17a

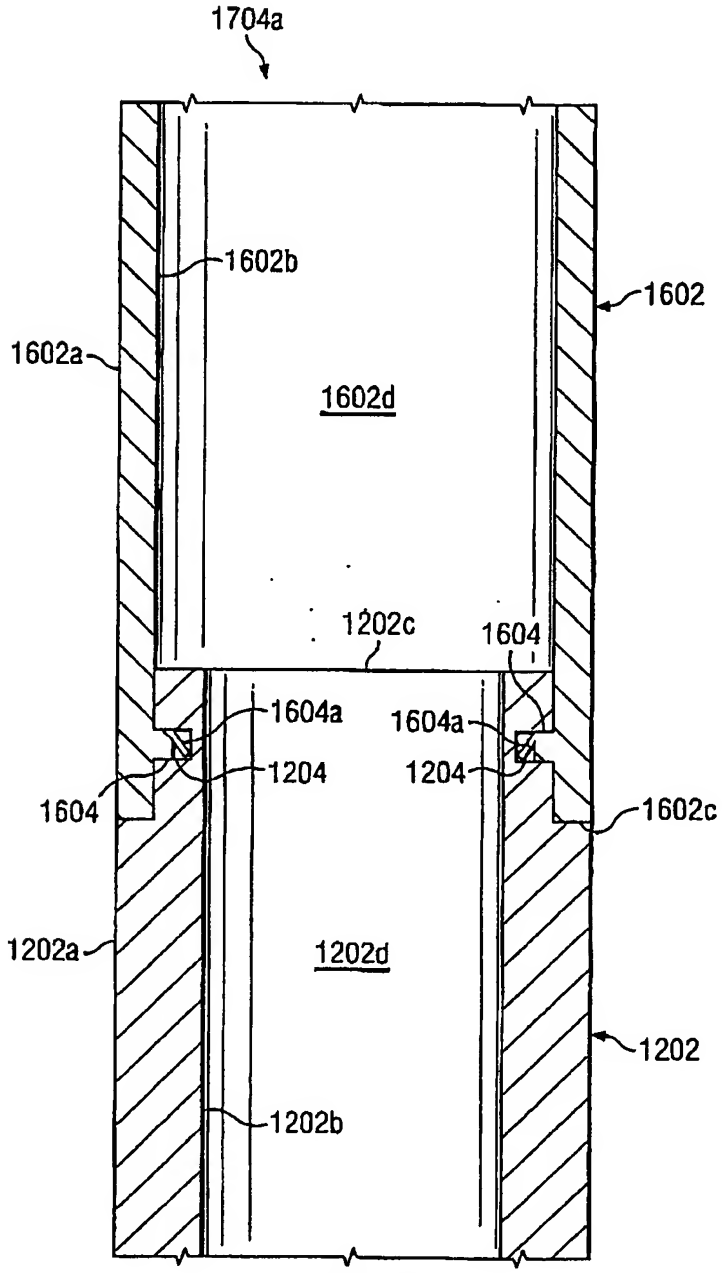
1704a
1602b
1602
1602a
1602d
1202c
1604
1604a
1604a
1204
1204
1604
1602c
1202a
1202d
1202
1202b

Fig. 17b

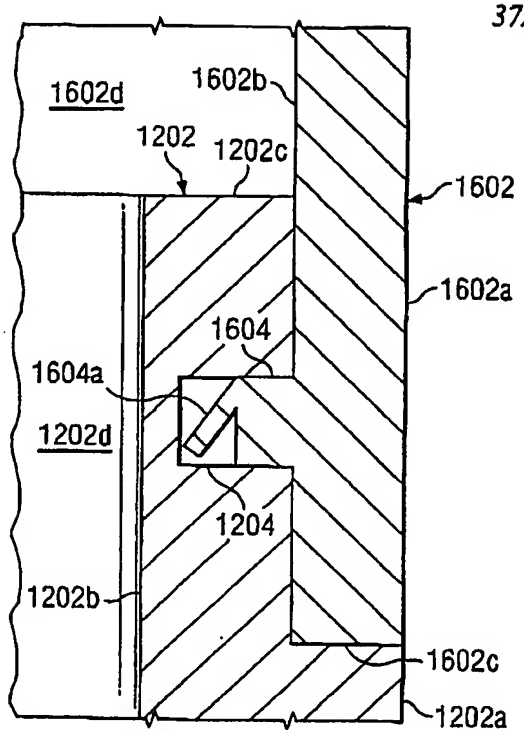

Fig. 17c

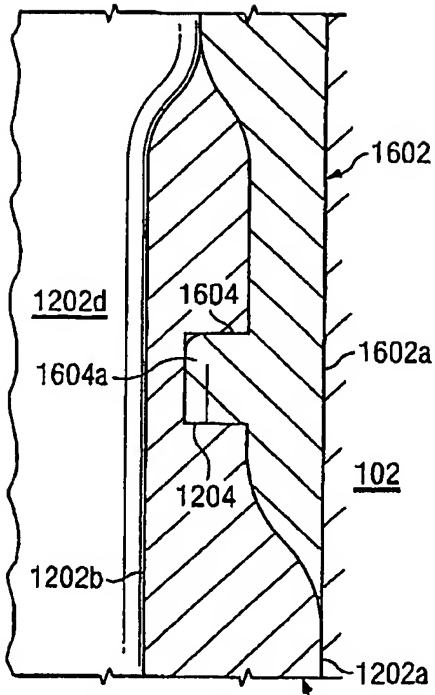

Fig. 17e

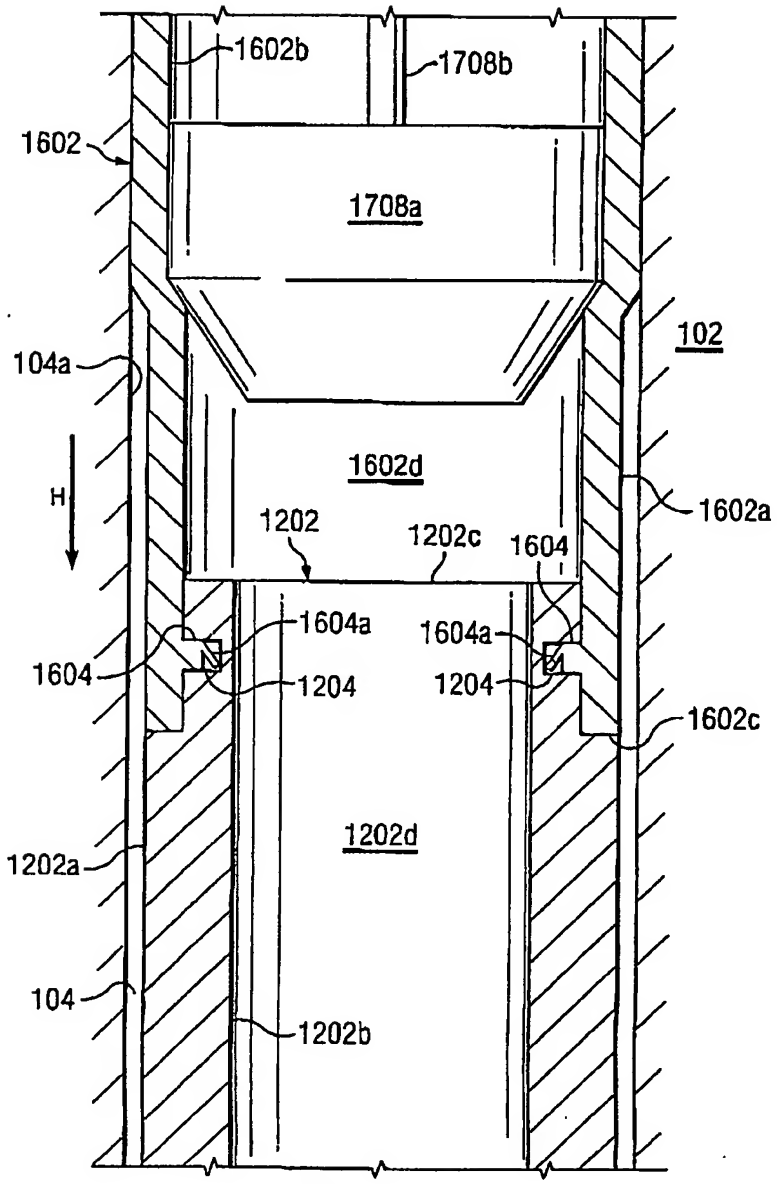
1602b
1708b
1602
1708a
102
104a
H
1602d
1602a
1202
1202c
1604
1604a
1604a
1604
1204
1204
1602c
1202d
1202a
104
1202b

Fig. 17d

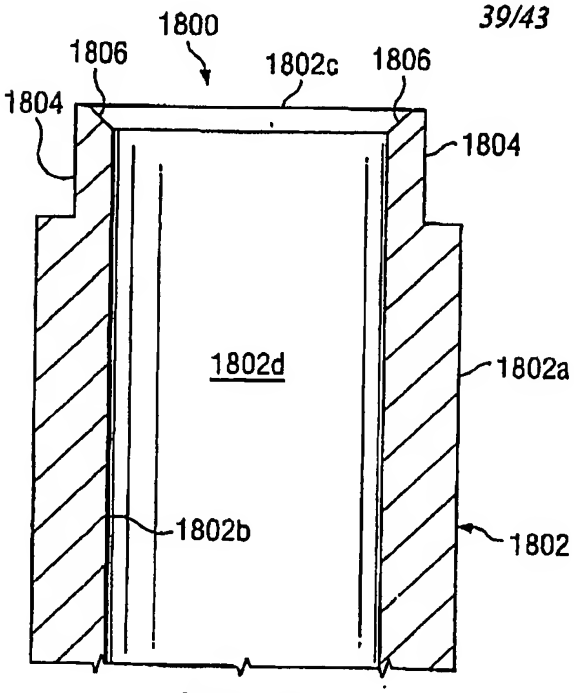
1800
1806
1802c
1806
1804
1804
1802d
1802a
1802b
1802

Fig. 18

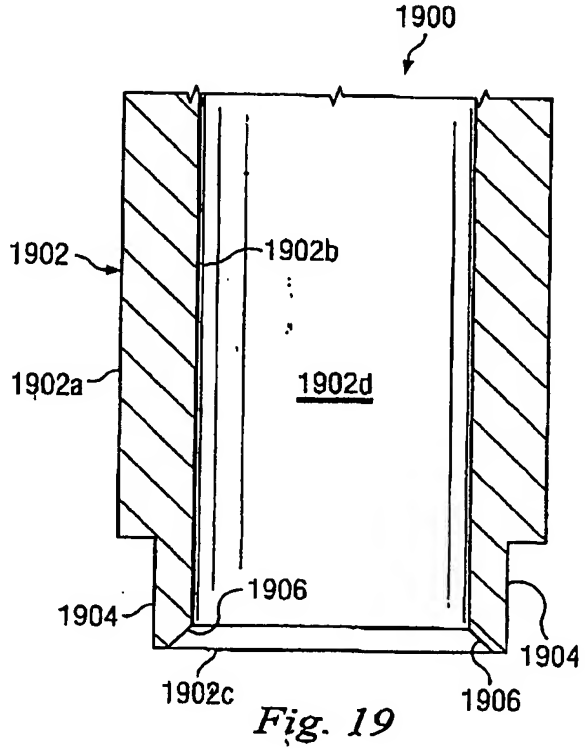
1900
1902
1902b
1902a
1902d
1906
1904
1904
1902c
1906

Fig. 19

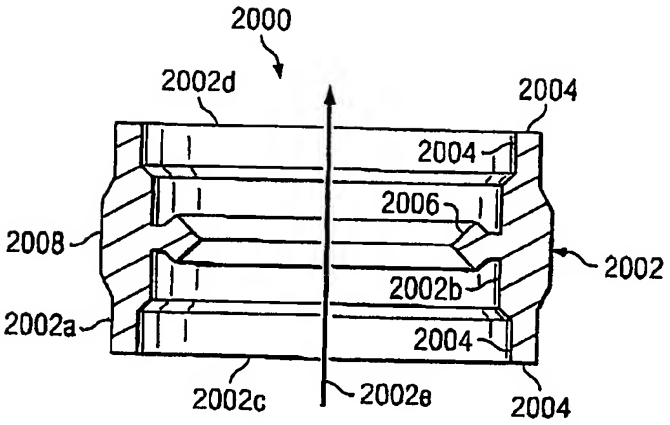

Fig. 20

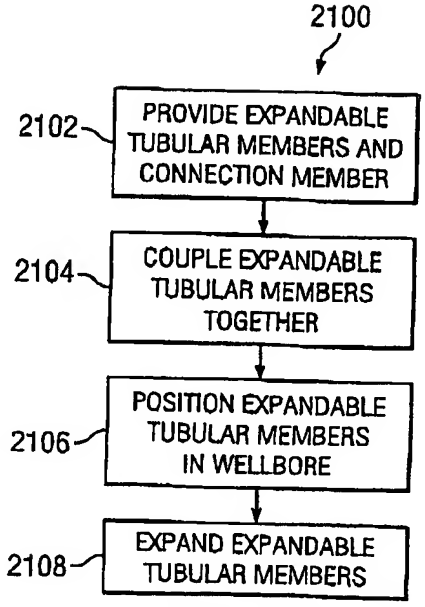

Fig. 21a

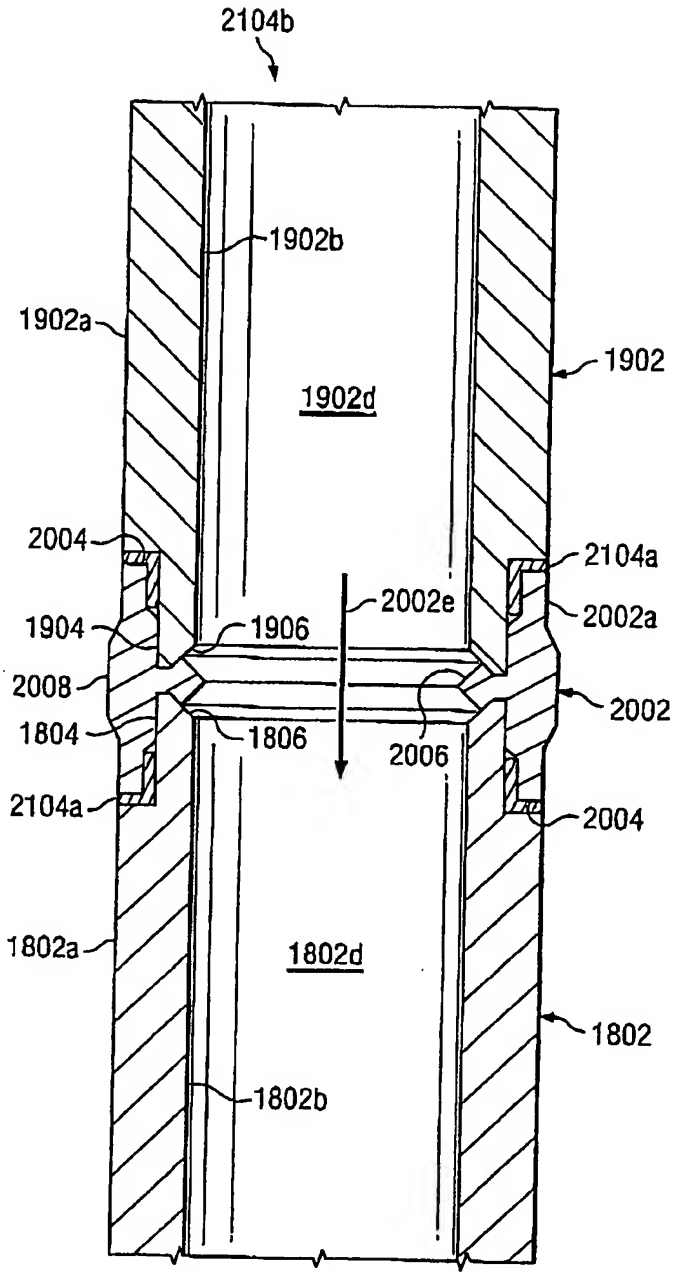
2104b
1902b
1902a
1902
1902d
2004
2104a
2002e
1904
1906
2002a
2008
2002
1804
1806
2006
2104a
2004
1802a
1802d
1802
1802b

Fig. 21b

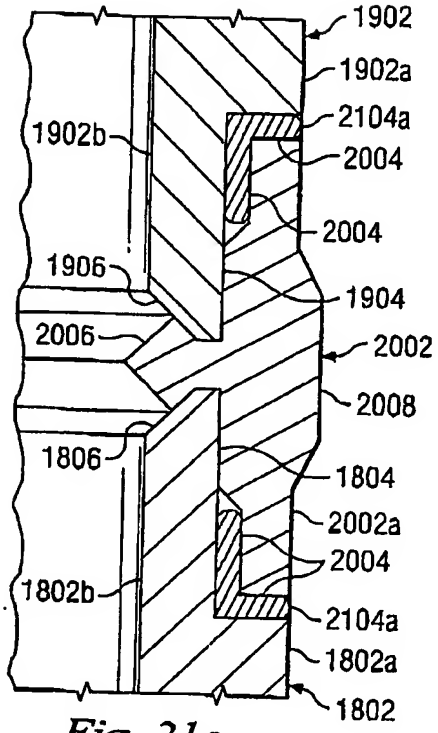

Fig. 21c

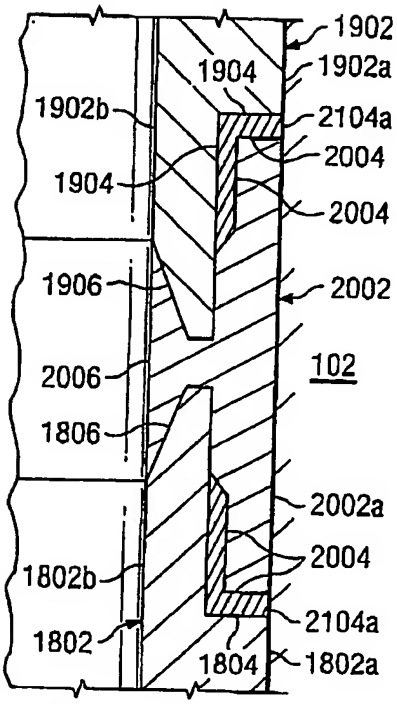

Fig. 21e

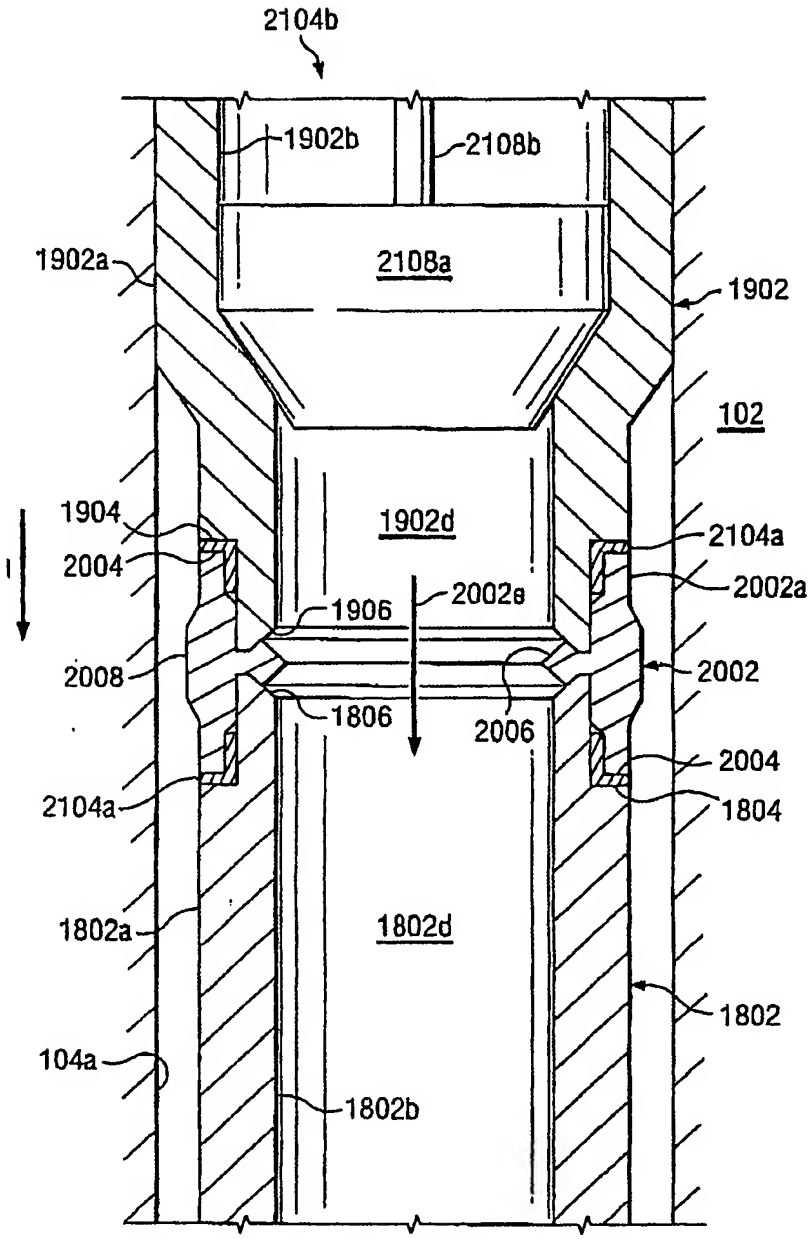
2104b
1902b
2108b
1902a
2108a
1902
102
1904
1902d
2104a
2004
2002a
1906
2002e
2008
2002
1806
2006
2004
2104a
1804
1802a
1802d
1802
104a
1802b

Fig. 21d